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*at the*

Economic Advisory Council

Committee on Nutrition in the Colonial Empire

FIRST REPORT—PART I

# NUTRITION IN THE COLONIAL EMPIRE

*Presented to Parliament by Command of His Majesty  
July, 1939*



LONDON

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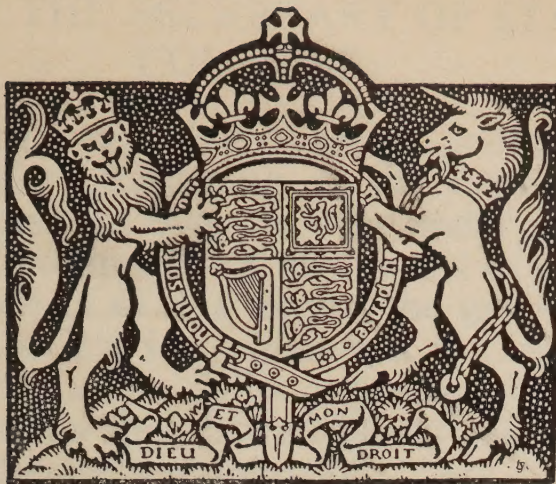
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WAS PRESENTED TO  
UNIVERSITY COLLEGE,  
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BY

PROF. A.V.HILL, F.R.S.





GREAT BRITAIN

Economic Advisory Council

Committee on Nutrition in the Colonial Empire

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## FOREWORD BY THE SECRETARY OF STATE FOR THE COLONIES.

One of the most far-reaching of recent political developments has been the steady broadening of the foundations of social policy and the extension over an ever wider sphere of the responsibilities of Government. A significant example of this can be found in the subject of this report, the problem of nutrition. It is only within the last few years that the importance of this question has begun to be fully appreciated and that it has entered people's heads that Governments should seriously and actively concern themselves about it.

While Mr. J. H. Thomas was Secretary of State for the Colonies he sent a circular despatch to all Colonial Governors drawing their attention to the subject and asking them to submit reports upon the standards of nutrition in their territories. Their replies provided a mass of very interesting and valuable information. It was accordingly decided to appoint a Committee of the Economic Advisory Council which would first of all consider these replies and make recommendations, and would thereafter remain in being to advise on nutritional matters.

I feel sure that it will be generally agreed that the report which the Committee have now presented is a most useful document, of all the greater value because of the full summary of information which they have provided in Part II as the background against which the conclusions of Part I should be read and judged. The fact that Colonial Governments have already ordered over four thousand copies of the Report indicates impressively the importance which they attach to it, and the wide distribution which they contemplate. I hope that it will also be studied by employers of labour in the Colonial Empire, by missionaries and by all others interested in the welfare of its people.

The question of nutrition should affect a great many aspects of Colonial policy, and the Committee have attempted with a large degree of success to cover all these aspects and to reach conclusions which will assist Colonial Governments to take practical steps to improve nutrition. In a report which deals with such a large variety of Dependencies many of the conclusions are naturally of a general character. It will be for each Colonial Government to consider the particular application of the many ideas and recommendations in the report to its own territories, and I am requesting Colonial Governors to keep me informed of the action taken.

His Majesty's Government are deeply indebted to the members of the Committee for the preparation of a report which will, I am confident, do much to promote wise policies and improved standards of nutrition in the Colonial Empire.

MALCOLM MACDONALD.



## COMMITTEE ON NUTRITION IN THE COLONIAL EMPIRE.

### TERMS OF REFERENCE AND COMPOSITION.

On the 23rd October, 1936, the Prime Minister appointed a Committee of the Economic Advisory Council with the following terms of reference:—

(a) to survey the present state of knowledge in regard to nutrition in the Colonial Empire in the light of the replies received to the circular despatch addressed by the Secretary of State for the Colonies on the 18th April, 1936, to the Officers Administering the Governments of Colonial Dependencies;

(b) to advise from time to time as to the measures calculated to promote the discovery and application of knowledge in this field.

#### 2. The Committee is constituted as follows:—

The Rt. Hon. Earl De La Warr, President of the Board of Education, *Chairman*.

Professor E. P. Cathcart, C.B.E., M.D., D.Sc., F.R.S.,  
Regius Professor of Physiology, University of Glasgow.

Mr. G. L. M. Clauson, C.M.G., O.B.E., Assistant Secretary,  
Colonial Office.

Miss P. C. Esdaile, D.Sc., Reader in Biology, University  
of London.

Dr. Raymond Firth, Ph.D., Reader in Social Anthropology,  
London School of Economics.\*

Professor N. F. Hall, Director, National Institute of Social  
and Economic Research.

Dr. J. M. Hamill, O.B.E., M.D., D.Sc., Senior Medical  
Officer, Ministry of Health.

Mr. Francis Hemming, C.M.G., C.B.E., Secretary, Economic  
Advisory Council.

Mr. E. M. H. Lloyd, Assistant Director, Food (Defence  
Plans) Department, Board of Trade.

Sir Edward Mellanby, K.C.B., M.D., F.R.C.P., F.R.S.,  
Secretary, Medical Research Council.

---

\* Succeeded Miss Audrey Richards, D.Sc., on February 21, 1938.



Dr. A. J. R. O'Brien, C.M.G., M.C., M.R.C.P., D.P.H.,  
Chief Medical Adviser to the Secretary of State for the  
Colonies.\*

Sir John Orr, D.S.O., M.C., M.D., D.Sc., F.R.S., Director,  
Rowett Research Institute.

Mr. H. S. Scott, C.M.G., late Director of Education, Kenya  
Colony.

Sir Frank Stockdale, K.C.M.G., C.B.E., Agricultural  
Adviser to the Secretary of State for the Colonies.

Mr. Hanns Vischer, C.M.G., C.B.E., Secretary, Colonial  
Office Advisory Committee on Education.

Mr. D. H. F. Rickett, Assistant  
Secretary, Economic Advisory  
Council.

Mr. C. G. Eastwood, Colonial  
Office.

*Joint Secretaries to  
the Committee.*

---

\* Succeeded the late Sir Thomas Stanton, K.C.M.G., M.D., F.R.C.P., on  
February 21, 1938.



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## CHAPTER I.

### INTRODUCTORY.

As our terms of reference indicate, our work as a committee originated in the circular despatch which on the 18th April, 1936, was addressed by the then Secretary of State for the Colonies to the Officers Administering the Governments of all Colonial territories. The purpose of that despatch, which we print as Appendix 1 to our report, was to draw the attention of Colonial Governments to the increasingly important position occupied by the question of nutrition in public health work and in general administration policy in regard to agriculture and many other matters. It also asked for a comprehensive report from each territory upon every aspect of the question.

2. The replies received from Colonial Governments to this despatch formed the primary material on which we have based our study of the question of nutrition in the Colonial Empire. They represented in the aggregate a formidable mass of documents far too voluminous to be published in full. At the same time they seemed to us to contain material of unique value not hitherto generally available. In some cases the reports prepared by local nutrition committees have been published locally. A list of those so published will be found in Appendix 2 to this report. But it appeared to us desirable that some means should be found to present within a reasonable compass a general picture of the conditions prevailing in regard to the nutrition of the peoples of the Colonial Empire. Such a document would, we felt, serve a number of purposes. Not the least important of these would be to provide stimulus and guidance to Colonial administrations, by furnishing them with information regarding the similar problems met with, and the measures taken to deal with them in other territories. It should, furthermore, represent a valuable addition to the growing body of information which is now being assembled, notably through the agency of the League of Nations, on the problem of nutrition in many countries. A summary of the information contained in the material before us has accordingly been prepared and appears as Part II of this report. In arranging for this document to be prepared we were fortunate in securing the co-operation of the Imperial Bureau of Animal Nutrition, and we are indebted to Dr. F. C. Kelly, B.Sc., Ph.D., at that time Deputy Director of the Bureau for the work which he did for us.



3. During the preparation of this report there has occurred the death of one of our members, Sir Thomas Stanton, K.C.M.G., M.D., F.R.C.P., who, at the time of his death was Chief Medical Adviser to the Secretary of State for the Colonies. The subject of our report was one which he had very much at heart and we wish to take this opportunity of expressing our deep sense of the loss which we have sustained by his death.

4. The present volume falls into two sections. In the first, Chapters II to V, we lay down the general principles for correct nutrition and discuss how far existing Colonial diets differ from these principles and what the effect of these differences is. In the second and perhaps more important part of our report, Chapters VI to XV, we discuss the various means for effecting improvement.

5. In the preparation of this volume we have received assistance from many sources, too numerous to mention in detail. Our thanks are due to them all. Special gratitude is due to Dr. B. S. Platt, who besides giving assistance in the preparation of various sections of the report, has also contributed a Memorandum of great value on rice and its importance for human nutrition, embodying the results of several years' work in the Far East. This we attach as Appendix 6 to our report.

---



## CHAPTER II.

## THE IMPORTANCE OF THE PROBLEM.

6. It will be seen from the Summary of Information which we print as Part II of our report how extraordinarily diverse is the material which we have had to handle. It relates to no less than forty-eight different territories with an area of well over two million square miles. It concerns a population of rather more than fifty-five millions of people of the most diverse ethnological origin, widely separated from each other in space and character and divided into countless groups having the most different food habits and customs that it is possible to imagine. What contrast could, for example, be greater than that between Hong Kong, with its dense population, mostly Chinese by race, its reliance on shipping and entrepôt trade and its dependence on imported foodstuffs, and almost any of the African territories, vast in extent and for the most part thinly populated, where imports of foodstuffs per head are negligible in value and a large part of the people obtain their support from subsistence agriculture; or between either Hong Kong or an African territory and the Falkland Islands, with a small population, all of European origin, mostly living a rural life and engaged in sheep farming? Again, even within a single territory the sharpest contrast may exist between the manner and conditions of life of two communities living in close proximity. Leaving aside the contrast introduced by immigrant communities such as Europeans or Indians in Kenya, Chinese or Indians in Malaya, there are sufficiently strong contrasts among the indigenous peoples themselves. For instance, there is the well-known case of the Kikuyu and the Masai tribes in Kenya, close neighbours of one another, the one living on a vegetarian diet chiefly of cereals and sweet potatoes, the other on a diet chiefly of milk, meat and blood. Parallel examples might be quoted from almost all the other African territories and from several Dependencies outside Africa.

7. We have found this variety of conditions fascinating but bewildering. It is because of this diversity that in spite of the very considerable body of information which we have had before us, much remains to be added before we can lay claim to a complete understanding of the problem. Nevertheless the very variety of the material has increased the scientific interest, for it provides opportunity to study the interplay of race and



environment from which the nutrition worker may learn much of the connection between diet and health.

8. This diversity of conditions would have been more manageable if we had felt that we had a securer basis of scientific knowledge on which to work. The science of nutrition is still young. "Thirty years ago," as was pointed out in the circular despatch, "it was generally believed that the dietary requirements of human beings are satisfied so long as they have a large enough quantity of food to eat. It is now known that the adequacy of a dietary depends on the presence of a number of factors and that with quantitative sufficiency there may be qualitative defects producing the most serious physical consequences." So much is known but even in regard to European conditions more detailed conclusions are still liable to be upset by fresh discoveries. Far less is known of conditions in tropical countries. On the medical side we are at the stage where almost every generalisation must still be regarded as tentative. While it is possible to say that some diets are obviously inadequate and others are more nearly adequate, we do not know at all exactly what are the minimum requirements for satisfactory nutrition in tropical countries. While we know that an improper diet through its enfeebling effect contributes to the prevalence or at least to the severity of many tropical diseases, such as malaria and various forms of worm infection, we do not know at all precisely to what extent this is so. While we know broadly the chemical composition of the main foodstuffs we do not know to what extent this composition varies according to the locality in which they are grown and the treatment which they receive before consumption, nor do we know how far these chemical constituents are available to the person who consumes the article, nor how that availability is affected by ill-health and disease. In regard to the more obscure and sometimes picturesque foods which figure in many tropical diets, we know little or nothing except that they are probably of considerable dietary significance. In East Africa, for instance, several hundred different kinds of wild green leafy vegetables are used as relishes or side dishes at certain seasons of the year. Their importance in the dietary is almost entirely a matter of conjecture. Similarly the exact dietetic significance is still unknown of the grubs, wood lice, caterpillars, locusts and flying ants which are largely eaten in tropical Africa, of the eggs of megapod and turtle consumed in certain islands in the Western Pacific, and of many other articles of colonial diet.

9. It will be appreciated that in view of the astonishing variety of conditions and the absence of exact knowledge it is very difficult to draw any general conclusions. Certain broad conclusions seem to stand out and these will be found stated in later sections of our Report. Even these, it is obvious, may need revision when fuller knowledge is available.



10. Of one conclusion, however, we have no doubt and that is the great importance of the subject. The Secretary of State in his circular despatch expressed the view that there was no doubt that the potentialities of improved nutrition in affecting not only public health but also the economic and agricultural problems of the day were great. "On the public health aspect, there can be little doubt that every part of the Colonial Empire would benefit from an improved nutrition of its peoples. On the economic and agricultural aspect, while I doubt whether the Colonial Empire has at present any substantial contribution to offer, by way of increased consumption, to the solution of world problems (the monetary resources both of its Governments and of its peoples being too slender to enable them to increase more than slowly their purchases from abroad), I do feel that within its own borders increased attention to dietetic needs might well lead to an amelioration of some of its own economic problems. Not only will greater consumption of foodstuffs within each territory, small though it be in terms of world consumption, increase the local market for local food products, but also expenditure on improved nutrition may well be directly remunerative itself, leading as it should to a greater well-being, greater efficiency in production and less waste of human life and effort." The attention which we ourselves have devoted to the subject only confirms the remarks quoted above. We have no doubt that improved nutrition will bring very great benefit to the Colonial Empire. In saying this we do not have primarily in mind the eradication of deficiency diseases, though that is in itself an important enough field for work. More important than the effect of malnutrition in directly producing disease is its effect in producing general ill health and lowered resistance to other diseases, inefficiency of labour in industry and agriculture, maternal and infantile mortality and a general lack of well-being. There can for instance be no reasonable doubt that wrong feeding is one of the principal causes of the very high infantile mortality which prevails in most Colonial territories. On this subject alone, there is an immense field for improvement. The aim then of those concerned with nutritional policy should not be only the negative one of eradicating deficiency diseases but the wider and more positive aim of securing, so far as economic circumstances and medical knowledge permit, that the populations under their charge secure optimum nutrition.

11. We have found some difficulty in setting bounds to our report. The subject of "nutrition" is not clear-cut and it has no well-defined boundaries. On the contrary it has bearings on almost every aspect of Government activity. It affects the policy of Governments on economic matters generally, on health and medicine, agriculture, animal husbandry, customs and education; it affects not only the central Governments but also the district administrations, municipal and local authorities and



all employers of labour. On the health side, the question of nutrition is intimately related to the prevalence of disease and to many aspects of public health work. We have felt bound to deal at length with questions relating to maternity and infant welfare services. With agricultural questions also we have felt it necessary to deal at some length. We have also included what we hope is a comprehensive survey of the means of social welfare propaganda in primitive communities. We hope that in interpreting them thus widely we have interpreted our terms of reference aright.

12. A large part of our Report is taken up with a discussion of the causes of malnutrition and the possible remedies. In discussing these remedial measures we have endeavoured to insist on the necessity of a realistic and practical approach to the problem. In Colonial conditions it is not useful to say that the aim should be that every man, woman and child should consume four or five or six pints of milk a week and that until they do so they cannot be well nourished, for such a state of affairs is far beyond the realms of possibility. Sometimes it is not useful even to say that they should drink more milk than they do at present, for very often they drink none at all and it is hard to see how they can in any measurable period of time be brought to drink any. This indeed is one of the most striking things about our inquiry, namely the almost complete absence from tropical diets (with a few exceptions) of milk and indeed of animal products generally, and the impossibility at present of supplying them in anything like the quantities which are normally regarded as adequate in European conditions.

13. There may be those who say, "How then can anyone in the tropics ever be properly nourished?" We are not among those people. It *must* be possible for all except the very young to whom milk supplies are available from natural sources, to obtain adequate nutrition on little or no milk. Certainly it is possible to make the degree of nutrition much better than it is at present even though sufficient supplies of milk are not available. There is, however, no easy formula to be laid down. The kind of diet that will give the best result must be worked out on the spot for each territory, having regard to the conditions of local agriculture and the purchasing power of the community. It is only with a full knowledge of local conditions that it is possible to specify what supplementary foodstuffs should be introduced into the diet. We have made, however, in Chapter VIII a number of suggestions of a general nature which will, we hope, be of value.

14. There is no doubt in our minds that over a large part of the Colonial Empire one of the most important causes of malnutrition is the low standard of living of many of its inhabitants.



The foodstuffs which they themselves produce, supplemented by money obtained from the sale of produce, wages or some other source is very often insufficient to provide adequate nutrition in addition to all their other needs. Ignorance no doubt is also a very important factor in the problem, particularly in such matters as infant welfare, and much can be done at the present economic level to improve nutrition by education, welfare services, the introduction of new crops and so forth. Much too can be done to secure adequate nutrition at the present level by increasing the quantity and variety of foodstuffs that a man grows for his own consumption, for all our evidence goes to show the importance of this. But when all is said and done we cannot get away from the fact that the present economic level is, broadly speaking, not high enough. The problem is fundamentally an economic problem. Malnutrition will never be cured until the peoples of the Colonial Empire command far greater resources than they do at present. With a few unfortunate exceptions the wealth of Colonial Dependencies has increased and, with temporary fluctuations, is increasing, but it must increase much further before the nutrition problem can be solved. From a nutritional point of view, therefore, the constant aim should be so to increase the resources of the colonial peoples that they are able either to purchase or to grow the foodstuffs needed for satisfactory nutrition.

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## CHAPTER III.

## THE PRINCIPLES OF CORRECT NUTRITION.

## (a) THE FOOD REQUIREMENTS OF THE BODY.

15. Although a proper supply of food is not the sole requirement for a state of good nutrition, nor an improper dietary the one and only cause of malnutrition, there is no doubt that normally the food a man consumes is the most important factor in his state of nutrition. Furthermore, although our knowledge of the fundamental processes, metabolic and otherwise, which underlie the state of nutrition is still very defective, it can at least be stated categorically that the food supplied must be adequate both in quantity and quality. This statement deserves emphasis since the tendency of more recent work has been to concentrate attention on the qualitative aspects of the diet and there is some risk that quantitative factors may be neglected.

16. The diet then must be sufficient in amount, i.e., it must contain enough materials of varying type to satisfy the energy demands of the body. This assessment is made in Calories. There is no subtle virtue in Calories as such; they are merely units of heat which are of use for calculation purposes. Calorie value is not synonymous either with food or biological value. Many organic substances possess Calorie values without being of any food value, e.g., coal. The energy requirements of the body are in the main dictated by the type and amount of muscular work carried out by the individual. The greater the expenditure of energy in the form of muscular work the greater the demand for an ample supply of energy-giving food. In estimating the amount of work done in a day it is essential that the method of performance, the duration of muscular effort and the rest pauses, voluntary and involuntary, be carefully observed over the working day. It is useless to carry on observation say over one hour, afterwards multiplying the assessed effort over this period by say eight and recording the result as that of an actual eight-hour day.

17. Other factors which influence the extent of the demand for energy are naturally age, sex and size. Climate does not apparently exert any very marked influence, although generally speaking it may be said that the colder and the more inclement the atmospheric conditions the greater is the need for Calories. Formerly in the assessment of the individual energy needs body weight alone was utilised although it was realised that such a



standard might be far from accurate, as a result of the variation in the material which constitutes the bulk of the body weight. The weight might in the main be due to muscle, or it might be due to fat or to large bones. These materials differ in their metabolic activity, hence in their demand for energy supplies. Muscle is very active metabolically, bone is much below muscle and fat is inert. Recent work has shown that a much better measure is obtained when energy requirement is related to the surface area of the body.\* When it is necessary to determine very accurately the needs of an individual it is customary to use as a basis the basal metabolic rate. This may be defined as the metabolic activity when the individual is lying at complete rest, warm, awake and in the post-absorptive state (i.e., about 12 to 15 hours after a meal). The general consensus of opinion supports the view that the metabolic rate of inhabitants of tropical and subtropical regions lies about 10 to 15 per cent. below that of inhabitants of the colder areas. Although the basal metabolic rate is of considerable interest from an academic standpoint, and in certain diseases is of considerable clinical importance, in practice it will be found that given the heights and weights of the people it is not essential to determine this rate when arriving at an estimate of the needs of a group of individuals.

18. As a broad approximation the Technical Commission on Nutrition of the League of Nations has stated the Calorie requirements as follows:—"An adult, male or female, living an ordinary life in a temperate climate and not engaged in manual work is taken as the basis on which the needs of other age groups are reckoned. An allowance of 2,400 Calories net (i.e., Calories available from food actually assimilated) per day is considered adequate to meet the requirements of such an individual." The Calories required by younger members of the family based on the foregoing figure are stated as "man values or coefficients." The values adopted by the Technical Commission on the basis of a total of 2,400 Calories are as follows:—

|                      |     |     |     |      |
|----------------------|-----|-----|-----|------|
| Male or Female Adult | ... | ... | ... | 1.00 |
| „ „ aged 12-19       | ... | ... | ... | 1.00 |
| „ „ „ 11-12          | ... | ... | ... | 0.9  |
| „ „ „ 9-11           | ... | ... | ... | 0.8  |
| „ „ „ 7-9            | ... | ... | ... | 0.7  |
| „ „ „ 5-7            | ... | ... | ... | 0.6  |
| „ „ „ 3-5            | ... | ... | ... | 0.5  |
| „ „ „ 2-3            | ... | ... | ... | 0.4  |
| „ „ „ 1-2            | ... | ... | ... | 0.35 |

\* The formula commonly employed for the determination of surface area is that of Du Bois:—

$$\text{S.A.} = W^{0.425} + H^{0.725} + 71.84.$$

in sq. cms.      in kilos.      in cms.

S.A. = Surface Area. W. = Weight. H. = Height. 71.84 = a constant.



The co-efficient for a man engaged in light work is 1.15; in moderate work 1.25; in hard work 1.50.

For children under one year the estimate should be made according to body weight, say 110 Cals. per kilo from 0-3 months, 100 Cals. from 3-6 months and 90 Cals. from 6-12 months. There is no special virtue attaching to these figures. They are simply arbitrary approximations which have been shown by experience to correspond on the whole satisfactorily with reality in temperate regions. They probably require some modification in tropical countries. They will, however, be found useful as general guides when comprehensive family studies are made.\*

19. When we consider the actual food source of the required energy it will be found that foodstuffs may be divided into two classes, A and B. Class A contains the energy-yielding group of materials (proteins, fats, carbohydrates), Class B materials which, although they yield no energy, are essential for all metabolic processes (water, mineral salts, vitamins). Energy is derived by a process of oxidation from the three components of group A, namely, proteins (like lean meat, white of egg), fats (like butter, ghee or edible oils) and carbohydrates (starches and sugars). These substances are usually found in nature as mixtures in ordinary foodstuffs. Lean meat, for example, has always a small amount of "hidden" fat and a trace of carbohydrate in addition to the protein of which it is mainly composed; white flour, which is chiefly carbohydrate, contains 10 to 12 per cent. of protein and a trace of fat. The body and the food are frequently likened to a machine with its fuel. The analogy is a most imperfect one. In a boiler the fuel is merely burnt to liberate energy whilst in the body the food, it is true, is also burnt or oxidised to yield energy but it differs from the ordinary fuel in that it can repair the breakdown of tissue which is constantly taking place and give the essential material for growth in the young.

20. The protein component of the diet holds a unique position. It may be regarded for all practical purposes as the sole source of the essential nitrogen. Without a sufficiency of protein in the

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\* An earlier League of Nations scale of co-efficients (that adopted at the Rome Conference in 1932) has been much used in tropical countries. It is as follows :—

| <i>Age.</i>  |     |     |     |     |     | <i>Co-efficient.</i> |
|--------------|-----|-----|-----|-----|-----|----------------------|
| 0 to 2       | ... | ... | ... | ... | ... | 0.2                  |
| 2 and 3      | ... | ... | ... | ... | ... | 0.3                  |
| 4 and 5      | ... | ... | ... | ... | ... | 0.4                  |
| 6 and 7      | ... | ... | ... | ... | ... | 0.5                  |
| 8 and 9      | ... | ... | ... | ... | ... | 0.6                  |
| 10 and 11    | ... | ... | ... | ... | ... | 0.7                  |
| 12 and 13    | ... | ... | ... | ... | ... | 0.8                  |
| 14 to 50 men | ... | ... | ... | ... | ... | 1.0                  |
| women        | ... | ... | ... | ... | ... | 0.8                  |
| Over 50      | ... | ... | ... | ... | ... | 0.8                  |



food, life would be impossible. Although protein can and does yield energy to the body it is of greater importance for the growth, maintenance and repair of active tissues like muscle. It also possesses very marked heat-stimulating properties. How much then of this valuable material should the average diet contain? The Technical Commission on Nutrition of the League of Nations has suggested that the average requirements will be met by the ingestion of 1 gm. protein per kilo body weight. This requirement might, however, be stated in another, and probably better fashion, namely, that calories derived from protein should form some 10 per cent. of the total calories ingested. It is certainly true, however, that the protein needs of the growing organism per kilo body weight are greater than those of the adult.

21. Another question frequently asked is whether when hard muscular work is done there should be an increase in protein intake, particularly in the form of meat. Rightly or wrongly when hard muscular work has to be done man usually demands an increase in his supply of protein, often in the form of meat. There is also a certain amount of evidence which suggests that virile groups of peoples on the average consume more protein than the less virile. There is, too, evidence to suggest that proteins derived from animal sources exercise a greater stimulating effect than those from vegetable sources. Yet on the other hand there is no experimental evidence to show that there is an excessive or increased breakdown of protein containing body tissues when muscular work is done and hence there should be no need for an increased intake of protein.

22. Are all proteins which exist in the various food materials of equal value to the human organism? Certain proteins, generally referred to as "first class" proteins or proteins of high biological value, are given first place. These proteins are, in the main, derived from animal sources. They are found, for instance, in glandular organs, meat, milk and eggs. Milk proteins are of particular merit; if whole milk in sufficient quantity is not available its place may be taken by skimmed milk, whether liquid or condensed or dried, which contains the full complement of all proteins contained in whole milk. In the vegetable kingdom proteins derived from sources like whole cereals, peas, beans, lentils, etc., are good. There is a general belief, although there is little scientific evidence to back the belief, that in a mixed European diet at least one-third of the protein consumed should be in "first class" form. Whether or no this proportion be correct, there is good evidence to show that in a diet containing proteins from various sources, a supplementary action can take place as a result of the mixture, with the actual enhancement of the biological value of the combined proteins.

A combination, for instance, of animal and good vegetable proteins will have enhanced value, and so will a combination of maize, millet and soya beans, or a combination of cereals, legumes and leafy vegetables.

23. It is sometimes argued that a considerable proportion of the proteins ingested must be in the form of animal proteins. Others hold that proteins solely or almost solely of vegetable origin, if obtained from various sources, are adequate for good nutrition. We think that in the present state of knowledge it would be rash to be too dogmatic on the subject, but as a guiding principle we may take it that it is at least desirable, if not essential, especially in the diet of the young, to include a certain proportion of protein of animal origin such as that contained in milk.

24. Fats and carbohydrates are in some ways chemically similar; they are both compounds of the three elements carbon, hydrogen and oxygen. Fats can certainly be formed from carbohydrate but there is no irrefutable proof that the reverse change can take place. Fat is a valuable store of energy but it is not so readily available as is the energy from carbohydrate. There is no general agreement as to the optimal amount of fat which should be present in an average diet. The average diet in Great Britain contains about 100 gms. derived from all sources (butter, milk, meat, etc.). When hard work, particularly in the open air, has to be done, the natural consumption of fat tends to rise. It is usually assumed that the amount of fat required in the tropics is smaller than that in temperate countries, though some at least of the diets of well-to-do Indians are rich in fats. Some fats in addition to being a source of energy are the vehicle for the conveyance of certain of the indispensable vitamins, notably vitamins A and D. Fat, or at least certain of the unsaturated fatty acids, play some obscure part in growth. It is also of great use in reducing the bulk of diet. We know very little about the metabolism of fat in the body beyond the fact that for perfect oxidation there must be present and available a certain proportion of carbohydrate. As it has been said, fats only burn in a fire of carbohydrate.

25. When we turn to the consideration of the third group of energy-giving foodstuffs, the starchy foods, the mixture of carbohydrates which make up the bulk of the average diet, there is little to be said beyond stating that there is every reason to believe that they, of all foodstuffs, yield up most readily their energy to the body. These starchy foods are abundant and cheap sources of energy and thus we can readily and at small cost adjust our energy intake to the energy output by increasing or diminishing the proportion of carbohydrate in the diet. In contradistinction to a widely held belief, recently ingested carbohydrate, even in the form of glucose, although it causes a very



rapid rise in the level of the blood sugar is apparently not available as an immediate source of energy for the performance of muscle work and yet it has a marked restorative action after the work is done. The sugar must apparently be converted into some other form, presumably into its storage form of glycogen, before it can be utilised. Hence in the case of athletes the excess sugar should be consumed some two days before the effort is due to take place. Although sugar is an important member of the carbohydrate group, in its purified form as white sugar it can be regarded as nothing more than a mere source of energy whereas, when taken in the cruder or less purified forms as syrup or treacle (molasses), there is ingested at the same time quite substantial amounts of valuable mineral constituents. (See further Appendix 5.)

26. To turn now to the group of non-energy-yielding substances, water, mineral salts and vitamins. A plentiful supply of water is essential as about 70 per cent. of the body weight is water. All metabolic reactions take place in a liquid medium and are, for the most part, associated with the passage of water into or out of the various molecules. Quite apart from the actual loss of water from the organism there is a translocation of water, in the form of digestive juices, etc., within the body which amounts to about two gallons per day. The water excreted from the body, more particularly by the kidneys, plays an all important part in getting rid of soluble waste material.

27. The various mineral salts play an equally essential role as they participate in probably all the tissue activities. Unfortunately as yet our knowledge regarding the actual part they play as well as the amounts which are required for normal activity is very scanty. Excessive loss of a simple salt like sodium chloride during sweating is now known to account for the distressing symptoms of "firemen's cramp." This cramp is common to those whose employment necessitates their exposure to high temperatures with consequent loss of fluid in the form of sweat. This sweat carries along with it sodium chloride, the loss of which in time can evoke severe muscular pains. These cramps can be alleviated or prevented by drinking salted fluids. It has also of course long been known that an adequate supply of calcium and phosphorus is essential for proper bone formation, that iron and probably a trace of copper are required for the synthesis of the haemoglobin of blood, that iodine is essential for the proper functioning of the thyroid gland and so on. In Europe with its large and growing consumption of sophisticated and purified foodstuffs there is an increasing probability that there will be a shortage of minerals in the diet.

28. Quite as important as their synthetic activities, however, is the part played by the various mineral constituents in the

regulation of the acid-base balance or hydrogen concentration in the tissue fluids. The following are some of the common natural (European) sources of minerals in the diet:—

Calcium.—Cheese, milk, green vegetables, egg yolk.

Phosphorus.—Cheese, oatmeal, dried beans, egg yolk.

Iron.—Liver, oatmeal, egg yolk, green vegetables, dried beans, whole cereals.

Iodine.—Fish, watercress, onions.

The amounts required for normal maintenance are at the moment speculative. The Technical Commission on Nutrition have suggested that for an adult an intake of about 0.75 gm. of calcium (more for growing children say 1.0 gm. and for pregnant and lactating mothers 1.5 gms.), about 1.0 gm. phosphorus and about 10 mgms. of iron daily should be safe.

29. Finally we come to the vitamins of which five or six have definitely been identified. These various vitamins play essential, but as yet not definitely determined rôles, in the normal metabolic processes. Some of them have been isolated in pure form like ascorbic acid (C), calciferol (D) or in precursor form like carotene (A) and have actually been synthesized in the chemical laboratory. Although our present knowledge enables us to cure or alleviate certain diseases, which are now recognized as being due, in the main, to vitamin deficiency, e.g., scurvy, beri-beri, we are still very much in the dark about the amounts of the various vitamins which are required for the maintenance of health. Still more are we ignorant as to the unusual needs which arise when a person is suffering from disease. It is more or less generally agreed that except under medical supervision it is best to take the necessary vitamins in the form in which they are provided by nature, as ill results may follow the overconsumption of certain at least of these vitamins.

30. The vitamins about which most is known are A, B<sub>1</sub>, C and D. Vitamin A is important for health and growth and apparently particularly for the normal functioning of the epithelial cells. There also seems to be some intimate connection between this vitamin and the regeneration of the visual purple in the retina. The following are some of the chief sources of this vitamin: butter, milk, cheese, liver, most animal fats (not lard), yellow and red fruits and root vegetables, green vegetables, fish liver oils and red palm oil. The vitamin may be present either in the carotene (or precursor) form as in certain fruits and vegetables which can be converted in the body into the active vitamin or in free active form as in, for instance, butter and fish liver oils.\*

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\* There are a number of carotenes only some of which are precursors of vitamin A. Foodstuffs which are rich in these precursors are yellow or red, although the colour by no means always implies their presence.



31. Vitamin B<sub>1</sub> is the vitamin the absence of which is associated with the appearance of beri-beri. Vitamin B<sub>1</sub> is widespread, being found with few exceptions in all the natural food-stuffs examined. Yeast, eggs, liver and green leaf vegetables and certain of the pulses are rich in it, whereas milk, meat and fish are poor sources. There is a certain amount of evidence to show that it exerts influence on the utilisation of the carbohydrate portion of the diet.

32. Vitamin C is the vitamin the absence of which is the causal factor in scurvy. As already noted the vitamin has been isolated in pure form, analysed and within recent years synthesized (ascorbic acid). It is found in fresh fruits and vegetables (oranges, lemons, mangoes, salads, tomatoes, etc.). It is readily destroyed on drying, cooking or exposure to sunlight.

33. Vitamin D is intimately related to the utilisation of calcium and phosphorus in the body and hence a deficiency of it is related to the disease rickets. One precursor of this vitamin is ergosterol, which on solar irradiation yields after a special process of purification a crystalline substance, calciferol, of very high antirachitic activity. It is now regarded as highly probable that this substance is one form of vitamin D in a state of purity. Vitamin D in addition to its antirachitic properties plays a part in the proper development of teeth. This vitamin is present in fat fish, fish roe, fish liver oils, egg yolk and, when the cows are exposed to sunlight, in milk and butter. It may also be supplied to the body in precursor form in green vegetables.

34. There may also be mentioned here vitamin B<sub>2</sub> complex, which contains among other components riboflavin and nicotinic acid; this is the anti-pellagra or P-P vitamin. It is not affected by heat but it is soluble in water. It is found in, for example, yeast, liver, certain green vegetables, whole wheat and bran. The other vitamin is vitamin E, which is found in greatest amount in green leaves and in the embryos of cereals, wheat germ oil being a very rich source. This vitamin seems to play some part in the control of the reproductive processes.

35. So astonishing and interesting have been the results of the experimental studies of vitamin deficiencies that there has been a temptation, not unfortunately always resisted, to ascribe without any real justification a large and varied collection of clinical phenomena to a deficiency of vitamins. So much has this been the case that Sir Frederick Gowland Hopkins, the initial discoverer of vitamins, has been constrained to write:—  
“ We know that a fault in quality may be as deleterious as a failure in quantity. This fact the general public is now rapidly assimilating though not always to its profit. Indeed, a certain vocal section of the public is (as it has always been) so perverse

in its views concerning food that it is almost necessary to remind it that after all quantity still counts. We cannot live on vitamins alone."

(b) THE SPECIAL REQUIREMENTS OF CERTAIN CLASSES.

36. At certain periods of life—during pregnancy, lactation, infancy and childhood—an extra physiological strain is imposed upon the body. At such times the general principles of correct nutrition already stated in the preceding subsection apply with even greater force, and moreover the body requires certain additions to or departures from the normal diet, to help it to meet the special circumstances.

37. During the whole process of pregnancy the mother is caring and providing nourishment not only for herself but for another body also. This puts a special strain upon her, to meet which special additions to the diet are required. In general, the state of nutrition of the mother, provided she is free from disease, does not seem to play any marked role in the development of the child *in utero* so far as size is concerned; but there is no doubt that if the supply of food to the mother be defective either in its quantitative or qualitative aspects, the growing foetus will deplete the maternal tissues of the essential material. Obviously in extreme conditions, where the state of nutrition of the mother is bad at the outset and if her supply of food be defective, the offspring must suffer. Under average conditions, however, if there be a shortage, it is the mother rather than the foetus which suffers during pregnancy.

38. The chief additional needs during pregnancy are for minerals and vitamins. The mineral requirements are considerably increased and if they are not supplied the mother will suffer. In a recent report issued by the League of Nations Mixed Committee on Nutrition it is pointed out that one of the commonest defects is a faulty mineral supply to the mother through which there is a deficiency of calcium salts for the skeleton and teeth of the growing offspring. This can be met from such sources as milk and vegetables or by the administration of additional calcium and of those substances which are a source of vitamin D, since this has a powerful influence in regulating the growth of bone.

39. The foetus also requires a large supply of iron and this has to be made good to the mother. Many women suffer from anaemia even in ordinary circumstances and under the stress of pregnancy the condition will probably increase with consequent bad results to both the mother and the child. This tendency to anaemia during pregnancy and the special needs of the foetal child make it very desirable that iron in good quantity should form a sufficient part of the nourishment of the expectant



mother: foodstuffs that are rich in iron are meat, egg yolk and certain vegetables, while there is evidence to show that the iron in whole cereals is specially well utilised.\* Iodine is also specially needed by the pregnant mother. At this time too it is more than usually important that the diet should contain adequate vitamin elements.

40. The diet should be a balanced diet, sufficient in quantity, varied in character and preferably containing a supply of protein of animal origin, especially in the form of milk. The actual demands for protein by the mother are not greatly increased by pregnancy as the growth of the foetus is slow. Minerals and vitamins should be supplied by giving as much as possible of the protective foods like milk, green leafy vegetables, fresh fruit, potatoes if available, beans and bean products, etc.

41. As already stated, the pregnant woman has special needs, but the demands made during lactation are much greater. The extent of the demand is determined to a large extent by the amount of milk secreted. This is especially true as regards the supply of protein. Milk contains about 20 gms. total protein per litre. To cover the demand made by the mammary glands and the ordinary tissue needs it is calculated that about 2 gms. of protein per kilo body weight, i.e. twice the average adult requirement, is needed daily. Apart, too, from the increased supply of protein the nursing mother ought to receive a good mixed diet, rich in vitamins and minerals.

42. Milk is, of course, much the most valuable food both as a source of protein, and of vitamins and minerals, etc. When available, either in liquid, condensed or dried form—dried skim milk is excellent—and when the income is sufficient to permit of the purchase of it without unduly contracting the consumption of other forms of food, it should be used as much as possible. When milk in adequate quantities cannot be obtained, then other means, more suited to the local circumstances, must be devised for filling the needs of the nursing mother.

43. As regards the infant, certain principles may be laid down. Complete breast-feeding of the infant is of very great importance; its importance can indeed hardly be over-rated. But even breast-feeding may be inadequate if the nursing-mother in her turn is not provided with proper nourishment. When a baby is breast-fed, the need for supplementary dietetic substances is largely diminished but nevertheless it may be desirable to include some such substance as cod liver oil to supply additional vitamin A and especially vitamin D and iodine and some form of fruit juice say, orange or mango juice, to supply vitamin C. The need for including food with a high iron yield to mothers has already been indicated: this is mainly due to the need of

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\* Only about one-tenth of the iron content of meat is normally available for human nutrition.



the foetal child. When the infant is born it has an abundant supply of iron stored in the liver but this is gradually used up and should be supplied artificially before the haemoglobin rate in the blood becomes too low. Iron-yielding foods should as a rule be provided for the infant over six months of age: it has been shown that infants thus treated have a lower sickness rate from infection than those for whom these foods are not provided.

44. Where it is impossible to attain the ideal of breast-feeding, artificial feeding of the infant must be carefully thought out. In such cases the inclusion of the different specific protective substances in the diet assumes much greater importance because with artificial feeding the common illnesses of infants such as rickets, defective formation of teeth and anaemia are much more commonly found.

45. The nutritionally important period does not end when the child ceases to be an infant. The next few years are also of great importance. To help him meet the strain of growth, the growing child requires protein-rich foods in a proportion much greater than that required by an adult. He also requires an adequate supply of the various vitamins particularly the fat-soluble vitamins. Moreover as the child is more liable to attacks of infective and possibly debilitating disease it is highly important that the diet should be both quantitatively and qualitatively adequate. Faulty feeding, of whatever nature, during childhood may account for markedly defective growth or other physical deficiency. It must however be remembered that if the faulty feeding has neither been too grave nor too prolonged ultimate recovery up to the normal standard on the resumption of an adequate diet will probably take place. This is one of the potent factors of safety provided by Nature. In assessing growth and state of nutrition the standards common to the race examined should be used and not some arbitrary standard based upon European growth curves. Heredity is indeed a factor to be reckoned with.

#### (c) OTHER FACTORS AFFECTING CORRECT NUTRITION.

46. We have set out above the main food requirements of the body as they are generally understood at the present time. Modern knowledge of nutrition has brought us to a point where we can lay down certain broad generalisations about the essentials both quantitative and qualitative of a satisfactory diet. But the test of a diet is its effect on individual health and well-being, and dietary standards must always be subject to qualification and revision in the light of actual observation of the effect of different habits of food-consumption upon physique and health. It is the inter-relation of diet and health which at the present stage of our knowledge is the most fruitful subject for study.



47. The analysis of this relationship between food and health is no simple matter. As our knowledge grows regarding the factors which affect the nutritional value of foodstuffs and the effects of food and other influences on the nutritional state of an individual, the complexity of the question becomes increasingly apparent, and it is evident that much fuller knowledge will be required before anything more than tentative conclusions can be reached. For instance, it used to be assumed that the nutritive value of a foodstuff could be determined once for all by analysis of its chemical composition in the laboratory. Recent investigations have shown clearly, however, that the biological value for the human subject may vary considerably. On the one hand the chemical composition of the foodstuff as actually consumed is by no means constant. On the other hand the power of the individual to benefit from the food he eats may vary greatly according to a number of different factors.

48. As regards the variations in chemical composition it is now common knowledge that the soil in which a foodstuff is grown, the method of manuring, the time and method of harvesting, the methods of storing, marketing, processing and cooking, have a very marked effect upon the value of the food as consumed so that if proper allowance is not made for these factors dietary calculations based even on accurate food consumption data may result in serious error. For example, striking differences may be found in the nutritional state of a group of workers fed in a communal kitchen by a food contractor and of similar individuals eating apparently the same foods in similar amounts, but in their home in a rural area. In the former case the food supplied may be a low grade of the staple cereal milled to an excessive degree, stale vegetables bought up cheaply and other similar foodstuffs, while in the latter case the cereal, having been milled at home, is not over-milled, the vegetables are eaten fresh and so forth. The result is that the nutritional state of the country dweller is generally considerably better than that of a similar individual living in the town.

49. As regards the power of the individual to benefit from the food he eats, many factors may react upon the state of nutrition by affecting the metabolic process in the body and so influencing the utilisation of foodstuffs. Among these factors are the mental state—unhappiness, worry and so forth—and many environmental factors, such as faulty hygiene, high humidity, overcrowding, noise and vermin, which all in one way or another interfere with proper rest and sleep. Other pathological states, traumatic and irritation factors, may be found occurring in a vicious circle together with food deficiency diseases. In diseases affecting the alimentary canal there is likely to be disturbance of absorption of food and increased



loss of nutritive values, as for example in diarrhoea. The requirements of particular food factors may be accentuated by disease or some phase of it, as in the case of fever or other diseases in which there is excessive blood destruction.

50. Again, while there is at present little precise knowledge on the subject, the nutritional requirements of an individual may, it seems, vary appreciably according to his race and the climate in which he lives. Thus in a tropical country where sunshine is abundant the requirements of vitamin D should be less than in a temperate country in winter where sunshine is comparatively rare.\* In a hot country a smaller consumption of fats will be required than in a cold country. Possibly also through long custom one race may have adapted themselves to some special feature in the diet which economically is easiest to obtain. Most Colonial dietaries, for instance, being largely vegetarian are bulky relative to their nutritive value and it may be that people who for generations have been used to vegetarian diets can tolerate a greater bulk than others.

51. Another factor for which allowance must be made is the interaction of various foodstuffs on one another. Much attention is now being given to the effects upon one another of the various components of a diet. Thus, as already stated, when proteins from different sources are fed as a mixture, their biological value may be greater than their values when fed singly. Again the ratio of calcium to phosphorus in the diet is important; also, no doubt, the amount of calcium in the presence of limited amounts of vitamin D. The disposition of "fibre" in foods of vegetable origin is probably of more importance than the total amount as estimated by chemical means. A similar consideration holds for the nutritional value of different meats and "cuts" of meat in relation to the amount and distribution of connective tissue. Traces of inorganic elements in foods may also be of importance in determining their realisable value for the diet. The vitamin B<sub>1</sub> requirements of the body seem to be determined to some extent by the Calorie value of the food or of the carbohydrate portion of it. The capacity of different foods for forming acids or bases in the tissues of the body is another factor of outstanding importance, and it seems that the contribution made by a foodstuff to oxidation and reduction processes in the body may also have to be taken into account in assessing its value.

52. Another aspect of dietary studies is the possible action of toxic substances in foods. In Western countries control has been

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\* It would, however, be rash to be too dogmatic on this subject. Rickets are known to exist even in the most sunny climates, e.g., in Iraq and Aden. The anti-rachitic quality of the sunshine may not be entirely dependent on the strength of the sun's rays. Moreover where purdah exists or the sun is too strong exposure to the sun may be avoided. Again, a summer's day in a temperate climate is much longer than a tropical day.



established of the effects on the body of bacterial and other contaminants including traces of poisonous elements introduced in manufacture. In the examination of dietaries such as those found in Colonial territories it may be well to remember that untoward results of certain dietaries may not always be sequelae of deficiencies and that cyanides, fluorides, products of parasitic growths and contaminants from storage are likely at times to occur in foodstuffs and to result in more or less insidious effects on the health of a community.

53. In all these ways it is becoming evident that the assessment of dietary deficiencies is a matter of considerable complexity. Some assistance may be derived from experiments on the nutrition of animals and from the experience of stock breeders and veterinarians. Even these observations however must be interpreted with caution. It is clear that the only satisfactory method of study is to make careful observations of all the relevant factors directly on the human subject. To this point we return in Chapter XIV.

54. Finally one of the important but too often overlooked criteria for the drawing up of dietaries is that the food prescribed, its cooking and its serving, should conform to the dietary habits of those to be fed. It does not matter how much better than the food to be supplanted is the substitute food whose introduction is sought; the initial trials must be carried out with care, and attention must be given to psychological factors. Appetite is a very subtle guide, tradition often salutary, but both can annoy and hamper the man who wishes to introduce other foods and other methods. Appetite may, it is true, be capricious but it may also be the manifestation of a very real need, as for instance the demand for certain mineral earths. It is not wise to ignore appetite until it can be proved to be wrong. There is a certain element of truth in the statement of Sir William Roberts many years ago that "the generalised food customs of mankind are not to be viewed as random practices adopted to please the palate or gratify an idle or vicious appetite. These customs must be regarded as the outcome of profound instincts which correspond to important wants of the human economy. They are the fruit of a colossal experience accumulated by countless millions of men through successive generations." If this be true of a community such as our own in Great Britain which for generations has been removed from close touch with nature and natural products, how much truer is it likely to be of a great number of those members of our Colonial Empire whose very existence, only too often, depends on their knowledge of these age old customs and dietary habits. This is not to say that these customs and habits are the best and only possible customs and habits but they should not ignorantly be cast aside until fully examined and tested.

## CHAPTER IV.

## GENERAL CHARACTER OF COLONIAL DIETARIES.

55. In this and the following chapter we shall attempt to give a brief indication of the general character of existing diets in Colonial territories, of the extent to which malnutrition exists and of the effect which it has on the health of the people. The task is not easy owing to the diversity of the material to which we have already referred and to the complications of other factors such as disease. In a survey such as this it is obvious that discussions must be confined to the salient points which are thrown into relief against the very varied background.

56. The first and most obvious feature of dietaries in Colonial territories is that, with some exceptions, they are predominantly vegetarian in nature and that relatively small quantities of animal products are consumed. Maize, rice, millets, coco-yams, ground nuts, beans, peas, cassava, yams, tannias, sweet potatoes, plantains, bananas, gourds, coconuts or other palm products and numerous green leafy vegetables are the main raw materials of vegetable origin from which dietaries are composed. Broadly speaking, some or other of these products are available everywhere, though the chief component of the diet varies from place to place.

57. It follows that one feature of these diets is that by Western standards an unusually high proportion of the energy value of the diet is derived from carbohydrates. This is at the expense of the amount of fat in the diets, which is usually low except in areas where coconuts or other palm products are largely consumed. Since it is necessary to consume two and a quarter times as much carbohydrate in weight to obtain the same amount of energy as from one unit of fat, it follows that the diets are also bulky relative to their nutritive value.

58. This is not to say, however, that too much food is consumed in the Colonial Empire. Far from it. There are few parts of the Colonial Empire where, except at feast times, people eat more than they ought to eat; much more often they eat a great deal less than they ought to eat. Though there is nowadays little or no actual famine, people frequently go short of food owing to bad harvests, locust invasions, or the absence of money to buy foodstuffs. If diets are sometimes bulky, the bulk is of foodstuffs which do not in themselves suffice for proper nutrition.



It is only in relation to the nutritive value that the diets are bulky.

59. Another characteristic of Colonial diets is that it is often chiefly by the consumption of one staple crop and one only that the necessary energy value is obtained. One of the most striking facts which emerge from our survey is the extent to which Colonial peoples are dependent upon a single crop for their main supply of food. In the majority of Eastern countries rice is the staple foodstuff and other elements in the diet are merely relishes or extras. What rice is in the East maize, millets, plantains or yams are in different parts of Africa. In the Pacific yams also form the staple food.

60. As regards animal products, it is true that the diet of certain pastoral tribes of Kenya and Tanganyika consists chiefly of meat, blood and milk, that in Northern Nigeria animal products predominate, and that to the nomad Somali camel's milk is the one essential to health and happiness. But the inclusion of animal foods in substantial quantity is the exception rather than the rule in the Colonial Empire. Meat, for example, enters but sparingly into the typical dietaries of Zanzibar, large parts of East Africa and the southern parts of the Gold Coast and Nigeria. Furthermore, when meat is available it is generally of poor quality, exceedingly deficient in fat and too expensive for the bulk of the population. In the West Indies the consumption of meat is perhaps a little more general.

61. As regards milk, the most important of all single food-stuffs, only one territory, the Virgin Islands, can boast "an unlimited supply of fresh non-tubercular cow's milk". In Somaliland there is a high consumption of camel's milk and certain African tribes are also large consumers of milk. Almost everywhere else no milk is consumed, or the amounts are so low as to be of little account from the nutritional standpoint. In many territories the cattle population is and will probably remain insufficient to supply the necessary quantity of milk. This situation is frequently aggravated by the further difficulties of unsatisfactory quality due to adulteration and contamination, and of much ignorance and superstition. In Grenada, for example, there exists a deeply-rooted superstition that milk is the cause of worms in children, and in the New Hebrides both the indigenous and immigrant population dislike milk. The fact that they regard it as a dirty food is not surprising in view of the unhygienic conditions which so often surround its production.

62. Of all animal foods, fish is perhaps the one which is or could be most often included in Colonial diets. Not unnaturally it is most used by those to whom it is most easily available, namely by people living by sea or lake or river. It is commonly

eaten either fresh or dried, but, apart from one or two exceptional instances is as a rule eaten only in small quantities as a relish or side dish. The craving for fish is so acute among the Gilbertese that they will put out to sea in face of almost impossible weather conditions to get it. On the other hand in British Somaliland (which has abundant other sources of animal food) there is a genuine contempt for fish and also eggs. Although the latter are plentiful in some territories they are not largely consumed, and as a source of animal protein are without significance in many Colonial dietaries.

63. It follows from the absence of animal products from the diet that it is low in proteins derived from animal sources. Nor is the deficiency made good by an abundance of good quality proteins derived from other sources. There is a deficiency of all forms of proteins. The protein is usually highest when the staple cereal is wheat and lowest when it is rice. The greater part of the supply of protein will probably be derived from the cereal. The balance is made up of such foods as beans, peas and ground nuts, and in some instances from roots and leafy vegetables; but in general far too little of these commodities is consumed.

64. There is also as already stated a general deficiency of fats. Apart from their value as a concentrated source of energy and their use in connection with cooking, fats serve as a vehicle for vitamins A and D and their precursors. In Colonial diets the fats are almost exclusively drawn from vegetable sources. In vegetable fats vitamin A occurs always in the precursor form, the preformed vitamin being found chiefly if not entirely in fats and oils of animal origin, especially those obtained from fish and fish livers.

65. Again, there is in general too low a consumption of green leafy vegetables and fruits. In view of the extensive use of cereals and the scanty use of milk and fats these constituents are very desirable as a source of calcium, of the precursor of vitamin A and of vitamin C.

66. Specific peculiarities in the supplementary foods consumed distinguish particular geographical areas. Thus, for example, olives and olive oil are characteristic of the diets of the Mediterranean Colonies, and dates of the diet of British Somaliland. The inclusion of sugar cane is an important feature of the diet in the West Indian colonies and other sugar-producing dependencies. Curry stuffs are a valuable adjunct of the food consumed in Ceylon.

67. The more normal sources of food supply are supplemented in many cases by wild animals and insects. We have already mentioned the consumption of such things as grubs, caterpillars,



locusts and flying ants. Many kinds of wild animals are consumed, though not usually with any great frequency. In the more closely populated territories these sources of food are naturally rarest. In some of the more primitive or thinly populated countries they are of some significance.

68. As regards mineral deficiencies, it has long been known that an adequate supply of calcium and phosphorus is essential for proper bone formation. Most of the foodstuffs which are highest in these properties are lacking in Colonial diets. Moreover when the water drunk is rain water there is no possibility of the deficiency being made good by a high content in the water. The same applies to iron, the absence of which is one cause of anaemia. The intake of sodium must also, it seems, be extremely low in many parts of the Colonial Empire, since the diet is largely composed of vegetables the salts of which are chiefly potassium salts. The "salt" used is also in many instances of vegetable origin. Crude salts of mineral origin and edible earths are however often found in the dietaries of Colonial peoples. In some northern areas of the Gold Coast, for example, the people drink water impregnated to a milky colour with kaolin in preference to clear water, a habit apparently similar to the "pica" or depraved appetite described by many observers in parts of Kenya. In North Borneo a predilection for edible earths is commonly seen, especially among women and children, and the indigenous Mayan Indians of British Honduras regularly consume a drink made with maize steeped in a solution of lime water.

69. As we have pointed out in Chapter III, paragraph 26, an abundant supply of water is essential to proper nutrition. In many territories there is at present a scarcity of water supplies. Particularly is this so in some of the South African High Commission Territories, the Northern parts of Nigeria and the Gold Coast, parts of the East African territories, Somaliland, the Aden Protectorate and parts of Palestine. In some cases the inhabitants may have to travel long distances from their homes to obtain their water. In other cases the whole community is nomadic, wandering from water-hole to water-hole.

70. As regards the vitamins, the general character of Colonial diets as summarised above suggests that there is a widespread deficiency of vitamin A. This is confirmed, as we see in the next chapter, by the reports from many territories of the specific diseases known to be caused by vitamin A deficiency. In diets consisting so largely of cereals there is a considerable risk that insufficient amounts of vitamin B<sub>1</sub> will be obtained whenever the cereals are taken in highly milled forms. The deficiency does in fact undoubtedly exist in many parts of the Colonial Empire, where it is the custom to consume polished or overwashed rice, as in Hong Kong and in the towns and some

country districts of Malaya and Ceylon.\* In more primitive communities there is less risk of vitamin B<sub>1</sub> deficiency, except perhaps when cassava is the staple.

71. The low consumption of green vegetables and fruits would suggest that there is a widespread deficiency of vitamin C. The low consumption of fats would in European conditions point to a deficiency of vitamin D. This is, however, normally counterbalanced in the Colonial Empire by the abundance of sunshine throughout the year, though there is evidence of rickets even in Aden. If there is a gross deficiency of calcium and phosphorus the sunshine will be ineffective.

72. It will be seen from this brief survey that there are few of the constituents considered necessary in Europe for a nutritionally adequate diet which are generally available in sufficient quantities in the Colonial Empire. After studying all the reports submitted by Colonial Governments and all the other available material, we have no doubt at all that there are few parts of the Colonial Empire (or indeed of any tropical country) where the diet of the majority of the population is at present anything like sufficient for optimum nutrition. Diets are frequently insufficient in quantity and still more frequently insufficient in quality. If they are bulky, the bulk is too often made up of foods that do not supply all the needs of a balanced diet. Judged by European standards they lack variety and they lack protective value.

73. We proceed in the next section to consider the effects of this state of affairs.

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\* See the memorandum regarding rice which is attached as Appendix 6.



## CHAPTER V.

## EFFECTS OF MALNUTRITION IN THE COLONIAL EMPIRE.

74. Food deficiencies may cause well recognised deficiency diseases. They are certain also to lead to general illhealth, to increase greatly the susceptibility to many other diseases and to impair efficiency and wellbeing.

75. In determining how far the absence of certain specific food factors leads to disease, one of the difficulties is that it is seldom possible in man to observe the effects of one food deficiency in isolation. Food deficiencies are usually multiple and the interpretation of their effects is usually complicated by the presence also of various infections. Some symptoms, particularly those of a general nature occurring in the earlier stages of a deficiency disease, may not only be characteristic of the lack of a particular food factor but may well be the result of disease processes unrelated or only indirectly related to the dietary. For this reason the correct interpretation of the facts is a matter of much difficulty. It is not always helpful or justifiable to translate the results of experiments on animals directly to man. The only satisfactory approach to the subject is a careful compilation and analysis of a multitude of detailed observations on both men and animals.

76. Nevertheless, a considerable number of specific deficiency diseases are now generally recognised. Some of these, such as scurvy and beri-beri, have been known for a considerable time. Others have been diagnosed only comparatively recently. The subject is one on which much still remains uncertain. New relationships between food deficiency and disease are still no doubt to be discovered. It is very possible, for instance, that tropical ulcers are directly associated with food deficiencies. Again, there is still considerable difference of opinion regarding the early signs and symptoms of deficiency diseases. While the latest stages are comparatively well recognised the early stages, in which of course the disease is much more susceptible to treatment, are apt still to pass unnoticed. Again the effects of food deficiencies have so far only been considered in relation to the more obvious parts of the body, such as the skin, eyes, teeth, mouth, bones and blood, and little attention has been paid to their effect on tissues and organs more difficult of access and study.

77. There is therefore much that is at present unknown with regard to the occurrence of specific deficiency diseases. Most, however, of the known deficiency diseases are reported from one part of the Colonial Empire or another, and from the information given it appears probable that in a number of Dependencies there are a great many more cases of these deficiency diseases than have at present been recognised.

78. Diseases caused by deficiency of vitamin A are perhaps the most common of all in the Colonial Empire. There are reports from a wide selection of territories of affections of the eye, night-blindness, xerophthalmia, keratomalacia and well-characterised changes in the skin sometimes called follicular hyper-keratosis, sometimes phrynoderma. The prevalence of Bitot's spots and xerosis of skin and hair are probably also due to insufficiency of vitamin A. So also is impaired growth.

79. Beri-beri, which is recognised to be caused by a deficiency of vitamin B<sub>1</sub>, occurs with frequency in most countries where rice is the staple food and is found in various parts of the Colonial Empire. It is common in Hong Kong, and in the Straits Settlements causes on the average about 900 deaths every year. Apart from the well recognised beri-beri, the nervous system and blood circulation are affected by deficiencies of vitamin B<sub>1</sub>, and there may also be oedema and loss of appetite. Such cases are probably widely prevalent in parts of the Colonial Empire where the full disease has not been recognised.

80. Pellagra, due to the absence of the P-P. factor (another member of the B group of vitamins considered with good evidence to be nicotinic acid or nicotinamide) is reported fairly frequently. It is endemic among people living too exclusively on maize or maize products. Stomatitis, which sometimes at any rate appears to be the result of a less severe lack of the P-P. factor, is more frequently reported. Absence of this factor probably also accounts for a number of lesions of the skin.

81. Scurvy, caused by absence of vitamin C, is reported only very occasionally in its classical form, chiefly from those few territories in which there is periodically a famine period. Absence of vitamin C leads also to increased fragility of the capillaries in various parts of the body and causes lesions of the gums and various skin affections. These conditions are seen fairly often at certain seasons.

82. Vitamin D deficiency results in the well known signs of rickets in children and in changes in the mineral content of the bones of adults with subsequent deformities. The structure of the teeth and their resistance to decay are also largely bound up with adequacy of vitamin D. In each case, however, other considerations are involved, and as we have already said the deficiency of vitamin D in Colonial diets appears to be largely



compensated by the regular exposure of the body to sunshine, since diseases due to the absence of vitamin D are not very often reported.

83. In regard to diseases and disorders caused by absence of food factors other than the vitamins, there are some reports of the failure of proper bone formation, which would point to an inadequate supply of calcium and phosphorus. There are also many reports of anaemia, but it does not necessarily follow that this is due to a deficiency of iron, since analysis is complicated by the fact that there are a number of infective and parasitic diseases, especially such as are common in tropical countries, which cause destruction of the red blood cells. Nevertheless, in a proportion of these cases the anaemia may be due to a deficiency of iron in the diet and possibly also of other dietary factors which contribute to the formation of haemoglobin and the red cellular elements in the blood. As regards sodium, it is known that excessive loss of sodium chloride during sweating, such as may well occur in hot countries in the course of heavy work, accounts for "fireman's cramp." The occurrence of this condition is occasionally reported.

84. Apart from these well recognised diseases there are reports of a number of disorders possibly of dietary origin which have not yet been positively identified, although they have already earned for themselves a definite name locally. These include chalchaleh in Somaliland, chiufa and onyalai in Northern Rhodesia, decoque in the Seychelles, kwashiorkor in the Gold Coast and burning feet and butterfly wing in British Honduras.

85. Beyond the comparatively well established diseases there is now a general consensus of belief that there exist with great frequency, especially in the tropics, deficiency states which prevent the full enjoyment of health. Because these states are less well recognised, they are more insidious than the clearly defined deficiency diseases and are much more important factors in the lives of the people. The data available do not enable us to say with any accuracy, except where definite deficiency diseases are reported, that this or that deficiency exists in this or that territory; but we believe that almost everywhere health is impaired to a greater or less degree by malnutrition. We would go so far as to say that for every recorded case of a specific deficiency disease there are hundreds of cases of absence of full health due in part at least to malnutrition. This conclusion is supported by the observations of competent observers in every part of the world and by the evidence of the startling improvement of physique, wellbeing and efficiency which have been discovered to result from additions to the normal diet in areas so different as Malaya, Ceylon, East Africa, West Africa and the West Indies. Much of this evidence will appear in subsequent chapters where we discuss particular aspects of the problem.

86. Moreover the prevalence of malnutrition aggravates many other diseases. A person who is not properly fed will be much more liable to chronic infection with disease and much less able to offer natural resistance to such infection. Many persons in the tropics become infected with disease of one sort or another but show no noticeable symptoms so long as their natural resistance is maintained. It is only when this natural resistance is weakened that the disease appears. The effectiveness of the resistance, while partly depending upon other factors such as infestation with hook worm, is largely dependent on the state of nutrition of the individual. Moreover, the badly nourished subject will take longer to recover from any disease and is much more likely to relapse. This is amply proved by the experience of hospitals and dispensaries in districts where the people are known to be undernourished. Their wards are often crowded with cases in which healing or recovery cannot take place until the physical balance has been restored by an adequate dietary.

87. This is particularly the case with ulcers and a number of skin affections, leprosy, tuberculosis and malaria. Tropical ulcers, indeed, as we have already said, may even be a specific deficiency disease. The bearing of defective nutrition on leprosy is being increasingly recognised. We now know the importance of this factor in the cure of the surface affections of leprosy and in the prevention of the concurrent affections which used to prevail and to cause the high death rate. In the same way it is now recognised that there can be no effective treatment of tuberculosis without an adequate dietary and that an ill-nourished person is particularly liable to infection. Malnutrition is equally important in its effect upon the incidence of malaria. Malarial infection is widespread in most parts of the tropics, but the state of nutrition may determine whether an epidemic occurs or not. This was well seen in Ceylon in 1933-4 when the Colony suffered from a widespread malaria epidemic. This was preceded by a drought, and drought conditions continued during the greater part of the epidemic period. As a result food supplies ran short and considerable sections of the population were reduced to the borderline of starvation and could offer little or no resistance to the disease. Simultaneously the rivers and streams were largely reduced to stagnant pools forming breeding places for the anopheles mosquito. The report on the epidemic indicates clearly the part that malnutrition played in relation to this outbreak. "Even," it says, "if the masses had been well fed and prosperous there would have been an epidemic of malaria, but the vicious circle of malaria and destitution acting and reacting on one another would not have been established and the mortality rate would have been lower, convalescence would have been shorter and probably the infectivity and relapse rates would have been less."



88. To sum up, Colonial diets are very often far below what is necessary for optimum nutrition. This must result not only in the prevalence of specific deficiency diseases but in a great deal of ill-health, lowered resistance to other diseases, and a general impairment of well-being and efficiency. There is in our minds no doubt whatever that these conclusions are correct. They should, we venture to think, have great significance for Colonial Governments, and we feel that they should affect many aspects of Government policy. We do not doubt that if it were possible (as unfortunately it is not) to remove at one stroke all traces of malnutrition in the Colonial Empire there would be an immense gain in physical health, in mental alertness and in material welfare. Money spent on improving nutrition should be a sound investment, yielding its dividend in the increased welfare of the community as a whole.

89. This then is the position. We have now to consider how matters may be improved.

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## CHAPTER VI.

## THE GENERAL CHARACTER OF THE PROBLEM.

90. The main causes of malnutrition in the Colonial Empire are in our view, first, that the standard of living is often too low; and secondly, that there exists widespread ignorance coupled with prejudice, both with regard to diet itself and with regard to the use of land.

91. Perhaps we ought to add also as a third main cause, disease. We have mentioned in an earlier section that, just as malnutrition reacts upon susceptibility to certain diseases, so those diseases react upon the state of nutrition of the individual. We shall not concern ourselves further with disease as a cause of malnutrition, since we may assume that Colonial Governments are doing all they can with the funds available to prevent and combat disease. It will be sufficient for our purpose to note in passing that many tropical diseases must necessarily affect very seriously the power of an individual to benefit by the food he consumes. This is particularly true of the various types of parasitic infestation which are widespread amongst the inhabitants of tropical countries.

92. The other two main causes of malnutrition, a low standard of living and ignorance, react to some extent on one another. If there were greater wealth in the Colonial Empire, Governments could spend more money on removing the ignorance, and if there were less ignorance, the available resources—be it lands, cattle or money—would be used to greater advantage than they are at present.

93. We shall have a good deal to say in later chapters about the ways and means of removing ignorance. We have no doubt, however, that a low standard of living is in most territories the fundamental cause of malnutrition, and we shall devote several chapters to a discussion of the many aspects of this question. In most parts of the Colonial Empire the problem, as we see it, is that its inhabitants—as indeed the inhabitants of many other parts of the world—have insufficient wealth either in food or money to supply their requirements.

94. A low standard of living does not normally mean in the Colonial Empire quite the same thing as in highly industrialized European countries. It would be a mistake to think of it as meaning, typically, that the individual has too little money.



Much more typically it means a shortage of the means of subsistence. In some parts of the Colonial Empire, particularly in parts of Africa, money has only been introduced comparatively recently and the economy is still to a large extent not a money economy but a subsistence economy. In such cases money is required chiefly for the purchase of clothing and for meeting tax payments for the services provided by the local authorities and the Central Government. In the provision of the essentials of life, such as food and housing, money plays little part; the bulk of the population are still agriculturalists producing their own food. From this almost pure subsistence economy, there is to be found every kind of gradation towards a money economy. In almost all Colonies cash crops have been developed to a considerable extent and every day money comes to play a more and more important part, while of course in the towns the economy is as much a money economy as in any other part of the world.

95. The pure money economy is however still the exception rather than the rule. For this reason it is difficult to measure the extent to which poverty is a factor in malnutrition. It would probably be easy to compute that the wages paid—say 10s. a month in East Africa, 15s. a month in West Africa or 1s. to 1s. 3d. a day in the West Indies—are not sufficient to provide a man and his family with the food that they ought to have.\* But it only follows that the wage-earner must be undernourished when he has no other source of income. Fortunately he very often has another source of income in the food which he or his family grow for themselves. Similarly, if the money income of an African tribe from the sale of cash crops is only just sufficient to pay their taxes to Government and to provide those necessities of life that cannot be produced locally, it does not automatically follow that the tribe is undernourished, for they may grow without difficulty all the food that they require.

96. But though exact measurement is usually impossible, we have no hesitation in saying that in almost every part of the Colonial Empire the total income of a very large proportion of the population is a long way below the minimum required for satisfactory nutrition. The reason for this is not necessarily that the available income is badly distributed, that some have

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\* For instance, it has been calculated that the minimum sum required to obtain a reasonably good diet (not an optimum diet) in Freetown (Sierra Leone) is between 6d. and 7d. per head per day, or say 15s. a month. That is just about the average wage received by the urban labourer, so that according to this computation if he is to feed himself decently there is nothing left at all for the food of his wife and family, let alone for his housing, clothing, etc., unless he has other sources of income. It would be a mistake to put too much reliance upon this or similar calculations, for the necessary statistical facts are hard to come by. Nevertheless, it does give a general indication of the position.

too much while the majority have too little, though this may be a contributing factor in some Dependencies. Much more fundamentally in our view it is due to the fact that the total income of the community is at present too low to provide optimum nourishment and at the same time to supply its other essential needs and all the services of local authorities and the Central Government.

97. In many parts of the Colonial Empire real wealth is increasing with increased development and, apart from the temporary effects of world-wide depressions, the increase is steady and continuous. In such territories it is possible to look forward with optimism to a gradual improvement in conditions, as economic circumstances permit. In some of the West Indies, such optimism will be more difficult. At present they are faced with an increasing population without any obvious prospect of an increase in wealth, whether from their export products or from any other source. We have no doubt that this is a problem which will receive the close attention of the Royal Commission at present investigating the position of the West Indies.

98. Increased development will inevitably lead to a great extension of the use of money. This change is bound to come; it is indeed essential for any substantial improvement in the standard of living. The change-over to a money economy will certainly bring difficulties and drawbacks. European history contains many instances of periods of political and social unrest which have accompanied the change-over from small-scale highly localised subsistence economies to wider monetary economies, and the task of adjustment in the Colonial Empire is not likely to be less difficult, for it is likely to be swifter than has usually been the case in Europe. The impact is upon something more than the traditional means of livelihood of the people, their method of raising and preparing their food, of cultivating their ground and storing their wealth; it is upon their whole social structure, because many of their economic activities have a social and cultural significance, and any change of them will make its impression upon their whole pattern of life and way of thought. It is not for us to concern ourselves with the social consequences of these economic changes. Governments are well aware of them and to be forewarned is to a large extent to be forearmed, for by many measures Governments should be able to soften the impact of the new forces and to assist society to adapt itself to them.

99. From the nutritional point of view the change-over is on a long view to be welcomed, for, as we have said, it is essential before any substantial increase in the standard of living is possible. Nevertheless there will be certain disadvantages even from the point of view of nutrition. For instance, as we show



later on, a tendency which may if unchecked lead to the formation of large urban proletariats in backward communities is nutritionally disastrous. Again among the rural population it is possible that the benefits of increased monetary wealth, which will enable them to vary their diet by purchase will, to some extent, be set off by the disadvantages of undue specialisation in production. Already in some parts of the Colonial Empire, where, for instance, rubber or sugar or cocoa are produced, the rural community tends to rely on the production of export crops to the partial exclusion of the production of food crops. With wise guidance and assistance from Government, however, these dangers can be guarded against. At present the farmer too often of necessity specialises in one crop because of the limitations imposed by conditions and his own ignorance. His diet could hardly with increased monetary wealth be more monotonous than it is now. On the whole there can be no doubt that the gradual disappearance of the old subsistence economy will be nutritionally to the good since without it there are narrow limits to the amount of development that is possible.

100. Our main concern at the moment is not however with the relative merits of a subsistence or a monetary economy. It is to emphasise the very large extent to which the problem of malnutrition is a problem of economic development. Whatever form that development may take, a primary need for the improvement of nutrition is to secure an expansion of the real income of the people of the Colonial Empire.

101. Primarily economic development in the Colonial Empire means improvements in agricultural production. There are, it is true, big towns in the Colonial Empire—such as Hong Kong, Singapore and Colombo—and they have their special problems, but the big towns are relatively few. Whatever the future may hold in store, the Colonial Empire at present is predominantly rural. Even Malaya, which has a larger urban population than any other part of the Colonial Empire, regards itself as primarily a rural country. Moreover, there are comparatively few territories in the Colonial Empire with large mining areas; Malaya, parts of West Africa, parts of East Africa and Trinidad are almost the only territories where mineral production is of importance. Predominantly the rural communities depend upon agriculture.

102. In most parts of the Colonial Empire the bulk of the foodstuffs consumed are produced within the territory of consumption. In some of the Eastern Colonies, Mauritius, some of the West Indies and in one or two other territories there are substantial imports of foodstuffs, but elsewhere, though there is plenty of room for increasing local supplies, imports form a negligible proportion of total consumption.

103. For all these reasons it follows that Departments of Agriculture and Veterinary Services have a most important part to play in promoting both the economic development and the nutritional welfare of the Colonial Empire. Our next chapter will deal with various general agricultural considerations, and the subsequent one with the desirable additions to colonial diets, most of which will be by way of locally produced foodstuffs.

104. But while the main problem is that of rural communities, the problem of the town-dweller where it arises is even more acute. If the state of nutrition in the country district is often bad, it is invariably far worse in the towns. The reasons for this are not far to seek. The dwellers in towns are entirely dependent for their livelihood on what they earn. Their wages are usually low and they are not able to supplement them by foodstuffs which they have produced themselves. The amounts which they must spend on other essentials, such as housing, are in comparison with the wages earned relatively high, and they find no lack of less essential ways of spending their money. They may also have developed a taste for European foodstuffs which are too seldom of nutritive value. Moreover they are as often as not country-folk by birth who do not find in the towns either the traditional foodstuffs and ways of cooking or the general social background to which they have been accustomed.

105. The precise nature of the urban problem varies in each territory, according to the state of civilization of its people and the type of social organization which is natural to them. Races for instance which habitually dwell in villages take more kindly to town life than those who are not habitually dwellers in villages or large communities. We think it safe however to accept the generalization that the poorest class of town-dwellers in the Colonial Empire as in most other countries is everywhere worse fed than their brothers in the country and that their state of nutrition is almost invariably bad.

106. The problem is not one of nutrition only. It is a social problem of great importance, full consideration of which would be outside our terms of reference. We would however emphasize how disastrous from a nutritional point of view (as well as from many others) is the formation of large urban proletariats in backward communities.

107. Another factor which is of great importance nutritionally in some Dependencies is the rapid increase in population that is at present occurring. In Malta, Ceylon, Basutoland, and some of the West Indian Colonies this problem is in varying degrees acute, for it is obvious that unless an increase in population is accompanied by a proportionate increase in the wealth of the community the result must be decreased wealth on the



average per head of population. The following table gives some striking figures:—

|                 |     | 1921.     | 1937.<br>(Estimated). | Per cent.<br>Increase. | Popn.<br>per sq.<br>mile<br>1937. | Birth<br>Rate. | Death<br>Rate. |
|-----------------|-----|-----------|-----------------------|------------------------|-----------------------------------|----------------|----------------|
| Malta ...       | ... | 212,000   | 265,000               | 25                     | 2,175                             | 33             | 17             |
| Ceylon ...      | ... | 4,505,000 | 5,780,000             | 28 $\frac{1}{4}$       | 224                               | 34             | 21             |
| Basutoland ...  | ... | 499,000   | 562,000               | 12 $\frac{3}{4}$       | 48                                | —              | —              |
| Trinidad ...    | ... | 366,000   | 456,000               | 24 $\frac{1}{2}$       | 230                               | 30             | 19             |
| St. Vincent ... | ... | 44,400    | 57,500                | 29 $\frac{1}{2}$       | 442                               | 39             | 16             |
| Barbados*       | ... | 156,000   | 191,000               | 22 $\frac{1}{2}$       | 1,151                             | 29             | 20             |
| Jamaica ...     | ... | 858,000   | 1,152,000             | 34 $\frac{1}{4}$       | 254                               | 32             | 17             |

\* The population of Barbados in 1896 was put at 185,000, much the same level as in 1937. The fall between 1896 and 1921 was primarily due to emigration.

The problem is likely to become more serious as infantile and general mortality decrease.

108. It is often not easy to propound any solution. It would seem that it must be found in one of the following courses, (a) emigration, (b) an increase of visible exports, (c) an increase of invisible exports, (d) an increase of home production. Of these emigration is the remedy which has been to some extent effective in the past—e.g., in Malta and the West Indies—but it is no longer practicable on any large scale. An increase in visible exports may be equally difficult—for instance, sugar is almost the only possible export crop of some of the West Indies and the exports of it are regulated by the International Sugar Agreement. Industrial development may sometimes be possible but here again the finding of overseas markets will be the difficulty. An increase in invisible exports may be more practicable. In some of the West Indian Islands for instance there are considerable possibilities of developing the tourist trade. In some of the African Dependencies an important invisible export is to be found in the earnings of emigrant male labour. Another source of invisible exports is expenditure by the Imperial Government, either as in Malta for defence purposes, or, as by grants from the Colonial Development Fund, for the general development of the territory. There are, however, obvious limitations to this source of wealth.

109. In these circumstances the most important measure to offset increased population must often be increased development of local resources for local consumption. A certain amount of development of industries to supply the home market may sometimes be practicable, but generally the main task must be to increase the home production of foodstuffs of nutritive value. Clearly in such circumstances the employment of the available land should be so planned as to yield its maximum value to the community.

110. Once more therefore we are brought back to the importance of agriculture. We now proceed to the consideration of this question in more detail.

## CHAPTER VII.

AGRICULTURE AND NUTRITION—GENERAL  
CONSIDERATIONS.\*

III. The nutritional problem being largely an agricultural problem, it follows that in framing agricultural policy the nutritional needs of the community are of the first importance. In ascertaining what these requirements are, those responsible for agricultural policy will need assistance from the health authorities. It is for the health authorities to say what are the main deficiencies of the diet of a particular territory, and for the agricultural authorities to consider how the deficiencies may best be met.

II2. There is therefore need for very close co-operation between the two Departments. Indeed there is really need for something more than co-operation. The knowledge of the doctor is apt to stop short at the analysis of deficiencies, and that of the agriculturalist to begin with the science of growing crops. Neither has the full knowledge to enable him to say authoritatively which foodstuffs are best able to remedy which deficiencies. For this purpose, if the co-operation between the two Departments is to be really fruitful the Medical Department must know something of the agricultural possibilities and limitations and the Agricultural Department something of nutritive requirements.

II3. Naturally the nutritional factor cannot alone determine agricultural policy. That policy must be designed to safeguard soil fertility and to conserve the soil against erosion. Land should not be exploited for a short-term benefit. This is fundamental. Due place must also be given to the development of money crops. Climatic conditions, the nature of the soil, marketing possibilities: these too must also be taken into account. Clearly, however, to be fully effective agricultural policy must take account of nutritional needs as well as of these other factors.

II4. If we may venture on a broad definition of the proper aims of agricultural policy, we would suggest that it should be somewhat as follows:—

Having regard to

(i) the nature of the soil and climate of each locality;

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\* *Note.*—In this chapter, and elsewhere in our report, we use the term “agriculture” and its derivatives to include also all forms of animal husbandry.



(ii) the traditions and practices of the people who use the land; and above all to

(iii) the paramount need for maintaining and where possible increasing soil fertility;

the aim should be the establishment of a balanced agriculture for the production of commodities (vegetable or animal products) to be used:

(a) as foodstuffs for direct consumption by the producer and his family, in which case they should be of the greatest nutritive value possible; or

(b) for sale or consumption elsewhere in the territory, in which case they should return the greatest cash value possible to the producer, while, in the case of foodstuffs, at the same time assisting in remedying the deficiencies of the diet of the people who buy them; or

(c) for sale in overseas markets, in which case they should return the greatest cash value possible.

115. Our chief concern in this and the following chapters will be with the production of commodities falling in categories (a) and (b) above. Commodities falling in category (c), namely products for export, concern nutrition only in that the greater the return from exports the greater will be the power of the producer to purchase the foodstuffs necessary for his welfare and the greater the available wealth upon which the local authorities or the Government can draw for purposes of social advancement, including education of the community on nutritional matters. In this sense any measure that increases the value of exports has a bearing on nutrition. We do not feel that we need interpret our terms of reference so widely as to necessitate a comprehensive review of the economics of colonial exports. It is, however, important to note that the yield of exports is apt to fluctuate very greatly. It is an unfortunate fact that the world prices of primary commodities are subject to more violent fluctuations than those of manufactured articles. The world prices of almost all the chief Colonial commodities have at one time or another in the last ten years been at double the lowest level reached during the same period. In some cases, for instance rubber and cocoa, the fluctuations are much greater. Moreover, since freight, insurance and middleman's costs fluctuate much less, the percentage fluctuations in the price on first sale are much greater. Something has been done by means of the international regulation schemes which apply to rubber, tea, sugar, tin and copper, to prevent the continuance of very low prices for a long period, but even these schemes cannot prevent (or at least have not prevented) considerable variations in price, and what the producer gains by the avoidance of extremely low prices he may lose (on the

short view) by the limitation of the quantity that he can export. The Colonial producer must, it appears, continue to expect to see a wide variation in his income from money crops.

116. In the case of the estate or mining company, the chief effect upon the producing territory of a fall in the price or quantity of exports is a smaller demand for labour and possibly a lowering of wages, but part at least of the drop may be met by drawing upon reserves and by reducing dividends paid to shareholders. This to some extent acts as a shock-absorber coming between the actual inhabitants of the Colonial Empire and the full effects of a depression. The small producer does not have this shock-absorber. At the same time, unless the whole of his land is devoted to production for export, which is fortunately not often the case, he can fall back upon the growing of foodstuffs, and this mitigates the hardship to him. For instance in Malaya during the years 1930 to 1933, when rubber could not be produced profitably, more vegetable products were grown and more home-milled rice was used, so that it sometimes happened that nutrition was actually better than in times of prosperity. Conversely when the price of cocoa in the Gold Coast rose after the war to over £100 a ton, the people did not bother to grow foodstuffs, so that there was at one time a real shortage of the primary necessities of life. Similarly it has recently been reported that the high prices of cocoa ruling in 1936-7 led to a shortage of foodstuffs in the subsequent season.

117. Family production of food to meet family needs is a great safeguard against some of the worst social and economic effects of fluctuations in the income from money crops. There are other reasons too, equally important, why it is most desirable that in every Colonial territory as many people as possible should themselves grow part at least of the foodstuffs that they consume.

118. In the first place the protective foods are usually more expensive to buy than others of less nutritive value. It is difficult to persuade a poor person to buy vegetables or fruit or animal products, for they seem to him to involve too large a disbursement of his scanty resources relative to their bulk. Unless therefore he has his own garden or his own animals, he will be likely to go short of the protective foods. Moreover, if he does buy them, they are often stale and have lost part of their nutritive value.

119. Secondly, as we shall show in a later chapter, we regard the general level of wages as usually much too low to provide by themselves the means of adequate nutrition, and an early increase in wages sufficient for this purpose will often only be practicable when the productive capacity of Colonial populations has been increased substantially above present levels. As



a long-term policy, increases in general productivity may provide the ultimate solution but in the meanwhile it is important that wherever possible the labourer should be able to supplement his wages by produce from his own garden or allotment.

120. Thirdly, it is generally accepted that an interest in the land stimulates a sense of self-reliance and responsibility and that there are many social advantages in the maintenance of as large a proportion of the community on the land as possible.

121. For all these reasons we make the following recommendations, the importance of which we desire to impress upon all concerned:—

(a) Colonial Governments should endeavour to ensure that as many people as possible should grow part at least of the foodstuffs that they themselves consume.

(b) Where a labourer for wages is more or less permanently employed on an estate, as in the West Indies, Mauritius, parts of East Africa and Malaya,\* the estate-owner should normally provide him with land for a garden and perhaps even require him to make full use of it; in appropriate cases the owner should also permit or even require the maintenance of animals for the production of meat or milk products. The report received from Trinidad states that time after time it has been remarked that those labourers who have their own gardens are in a far better position than those who do not have this accessory means of balancing their budgets. This instance could be paralleled by many others. In some territories it may in fact be necessary to require by law that a certain proportion of estates should be given over to the production of foodstuffs either by the estates themselves or by co-operation with resident labourers. Satisfactory fencing should be provided for food gardens and allotments, wherever the prevalence of predial larceny, i.e. the stealing of food on farms, causes difficulties.

(c) Where there is a landless class, Colonial Governments should do all they can to provide them with at any rate some land. Attempts are now being made in the West Indies to develop peasant agriculture by settlement of families on whole-time holdings. This is very desirable under certain conditions and if adequate provision is made for supervisory and instructional services. At the same time cottage or food garden holdings which only require part-time attention may be no less valuable. Experience shows that it is not easy though by no means impossible

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\* See further paragraphs 282-295 below. In Malaya every estate is required by law to set aside one-sixteenth of an acre of land for each labourer who has dependents.

to make a success of land settlement schemes where the peasant is expected to make his entire living out of the produce of his holding. The settlers require careful selection and supervision, and progress on these lines must be slow and expensive. The part-time holding or allotment which is only intended to supplement the normal wage may bring increased well-being to a larger number of people at less cost to the community. Again adequate protection against predial larceny will be required.

122. A factor which is often of importance in relation to nutrition is land tenure. The growth of crops of nutritive value such as fruit may be hampered by the fact that the local system of land tenure is such that the individual has no inducement to plant crops of a permanent nature. Often where there is shifting cultivation or where land is held in common the individual may next year have no rights over the piece of land he holds this year. Naturally, in these circumstances he will not spend money or energy in maintaining the fertility of the land or in planting fruit trees which will only come into bearing some years later when someone else holds the land. The means of altering this state of affairs will vary in different territories. It is a difficult and technical question which we do not propose to discuss in detail. Sometimes it may be possible to modify the existing system so as to permit the individual to retain a right to the permanent trees he plants. Such is the system which seems to be developing in West Africa. Indeed the planting of palms and fruit trees near houses is, we understand, often the first step away from a system of shifting cultivation. Sometimes, where the recognition of anything in the nature of permanent rights of individuals over land is not regarded as appropriate, a form of communal development may be possible. For instance, the report received from Nyasaland suggests that villages might be encouraged to plant communal orchards under the control of the native authority.

123. This we regard as a most interesting suggestion, since it implies the possibility of development without sacrificing the advantages of the communal system. At the same time development will probably be quicker if, by judicious modification of existing customs, the progressive individual can be given some security of tenure and so be encouraged to make improvements on his own account. In any such modification however great care will be necessary to see that the community as a whole does not suffer for the benefit of the individual. Changes must be gradual and must meet with the consent and approval of the community. Before any change is carried into effect, careful study of the local system of land tenure should be made in order that the existing relation between communal control and individual rights may be taken into account. It will be



universally agreed that any very rapid change from communal tenure to anything like individual freehold ownership may well be disastrous. Nor should it by any means be taken for granted that unrestricted freehold tenure is the ultimate ideal. Even in territories such as the West Indies, where the land legislation has been imported wholesale from this country, it is held by many to be more than doubtful whether out-and-out freehold tenure is productive of the best results. It seems desirable that at least there should be some obligation on the part of the occupier of the land to comply with certain standards of cultivation and conservation. The whole subject of land tenure is, however, a technical one of which we have no special knowledge, and we do not feel competent to do more than indicate the bearing which it has on nutritional questions.

124. Another factor which sometimes prevents increased growth of food crops is the prevalence of predial larceny, that is to say the stealing of food from farms. This has been mentioned in the reports from several of the West Indies and from one or two other territories.

125. In many parts of the Colonial Empire the seasonal fluctuation of diet is a factor of importance. Happily the days of absolute famine are almost a thing of the past, but in many parts of Africa there is normally a period of acute shortage in the two or three months preceding harvest and this may at any time be aggravated by drought or the ravages of locusts. Apart from the pre-harvest shortage of the staple foodstuff there is often, in countries where there is a marked dry season, a shortage of the important protective foods in a fresh state just before the rains begin. At this time the staple foodstuff may still be holding out, but there may be few fresh fruits or vegetables, either wild or cultivated, and in consequence there may be serious dietary deficiencies. In West Africa, leaves of selected trees, shrubs and plants are dried and used in the dry season. How far they go to make up the deficiencies of fresh foods it is not possible to say. After the rains come there will be more extras—wild food plants, the leaves of trees, etc., as well as cultivated vegetables—and next year's supply of the staple foodstuff will be in the ground, but this year's supply of it may be running short. There may thus be two periods of shortage, one a shortage of extras just before the rains and the other a shortage of the staple foodstuffs some time after the rains but before the new staple crop is harvested.

126. The subject is one of considerable importance, especially in Africa. Shortages of extras will not lead to actual starvation but they may be nutritively very significant. Probably the most useful remedial measure is the encouragement of the drying of green foods by methods which preserve their nutritive value, a subject to which we return later. Shortages of the main staple

may be even more serious. Remedies for this must vary in each district. In some places there may be need for better storage facilities, though such facilities will fail of their purpose unless a greater spirit of foresight is shown by the people who at present improvidently consume too large a proportion of their staple crop soon after the harvest. The storage of food in tropical conditions is difficult and indifferent storage may lead to waste. We discuss this question later on. Much may also be done by developing early maturing or drought-resisting varieties of the normal staple crop. Elsewhere the remedy will be the planting of special famine reserve crops. Among these cassava is pre-eminent as it is highly drought-resistant and its tubers can be left under ground for a long time, sometimes for as much as two years or more, thus avoiding the necessity for extensive storage accommodation. It has been the salvation of large areas in the dry parts of Uganda, Northern Rhodesia and many parts of West Africa.\*

127. In some territories an important factor is the absence for considerable periods of a large proportion of the adult male population who migrate in search of employment to other territories. On the one hand this tends to raise the level of nutrition amongst their own tribe since they often send home a considerable proportion of the wages they receive. On the other hand it may upset the system of cultivation in the villages from which migration takes place leaving an undue amount of work to be done by the women. This will affect adversely the amount of food available for consumption by the women and children.

128. One of the most potent means of increasing foodstuffs for the people is by increasing the yield per acre from their existing crops. Probably in every part of the Colonial Empire in which the inhabitants grow food for their own consumption the yield could be substantially increased on the one hand by the use of better seed and on the other hand by better methods of husbandry combined with the use of organic manures or composts. Many Colonial Departments of Agriculture have already done much valuable work on both these subjects.

129. As regards the use of better seed, there is still great scope before the plant breeders in the Colonial Empire in the improvement of food crops. There still remains much to be done in the improvement of crops by selecting high-yielding strains of local varieties, by plant-breeding, by introducing new varieties and by the further trial of crops not now generally grown. Many factors have to be taken into account, yields, nutritive values, ease of cultivation by the methods common in the locality, ability to tolerate mixed cultivation, date of

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\* As we shall show in the next chapter, however, cassava is low in protective value. It is therefore not satisfactory as the *sole* staple crop.



ripening, liability to destruction by pests in the field, keeping qualities in store and the prejudices of the local population. These factors naturally vary from place to place and there is therefore room for much experiment in almost every territory.

130. As regards the improvement of methods of cultivation, this is of even more importance in that unless it takes place the fertility of the soil may decrease from year to year. Soil deterioration is common throughout the Colonial Empire and the need for soil conservation and the prevention of erosion cannot be over-emphasised. The first and most fundamental objective of all agricultural policy must be to conserve the land and at the least to maintain if not increase its fertility, for the wealth of the soil is the capital of an agricultural country. With bad farming—such as now too often exists—this capital can be squandered very quickly and if it once disappears it demands great effort and a lengthy period to recreate it. A satisfactory system of land usage must include the maintenance of forest cover for the protection of water supplies, the maintenance of pasturage on lands suited for such a purpose, and the development of arable farming on other lands. We repeat: soil conservation and the maintenance of soil fertility must be the first aims of colonial agricultural policies and no agricultural system can be considered to be sound if it is not based on the correct usage of the land.

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## CHAPTER VIII.

## THE DESIRABLE ADDITIONS TO COLONIAL DIETS.

## (a) NEW CROPS.

131. We shall consider in this chapter the foodstuffs which in the circumstances of the Colonial Empire seem to offer the best means of remedying the dietary deficiencies which we have described in Chapter IV. We have tried to be strictly practical. It is not enough to point out what is scientifically desirable. It is also necessary to take into account what is practicable. Ignorance, prejudice, local customs and habits, poverty, disease, climate: these and many other factors must all be taken into consideration. Always and at all times, the desirable must be conditioned by the practicable.

132. The objective as we see it is that the daily intake of foodstuffs at all seasons of the year should be sufficient to meet on the one hand the total energy requirements of the individual, and on the other hand his requirements of the various protective food factors. No amount of vitamins and minerals could ever make a man well-nourished if his energy requirements were not met. The first requisite therefore is that energy needs should be supplied. At the same time energy-giving foods are not sufficient by themselves unless the accessory food factors are also present. A good working rule for those who seek to improve Colonial dietaries would be to endeavour to increase the quantity of foodstuffs consumed by increasing the variety.

133. Very striking differences occur in the energy yield per acre of different forms of cultivation. Animal products for instance have a low energy yield per acre. Thus it is estimated that in the United States, although only about 40 per cent. of the energy value of the diet is derived from animal products (meat, milk, poultry and eggs), nearly three-quarters of the crop land is used for their production and almost all of the pasturage. A substantial part of the diet is thus made up of elements which, though of high nutritional value in other respects, are of low energy value in terms of energy yield per acre. Cereals on the other hand have a high energy value per acre, and of all cereals rice has the highest yield. It has been found that, taking in each case an average yield on soil suitable for the crop, a great deal more food measured by Calorie value can be produced from one acre of rice than from a similar area of any other cereal.\*

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\* See further Appendix 6.



When a cereal or other food is converted into meat or milk, though there is an accession of other factors, there is an extensive loss of energy.

134. These considerations are of importance where population is high relative to the agricultural land available and where nevertheless imported foodstuffs can do little or nothing to supplement local production. At the same time energy by itself is not enough. Other things being equal, the crop which has the most protective food factors in addition to a high energy yield is to be preferred over that which gives little besides energy. An example will illustrate this point. In Travancore, in South India, the staple crop used to be rice. Rice is still grown on the low-lying lands and considerable quantities are imported, but with the increase of population in recent years, the state has had to find food crops which will grow on higher lands, and cassava now forms an important part of the food supply. The energy yield per head of population is probably no less than it used to be but there has been a marked deterioration in health, which it seems must be due to the fact that a large proportion of the population now live on cassava and not rice as their staple foodstuff. Cassava contains a much lower quantity of the protective factors than rice and therefore nutrition was bound to suffer if means were not found of replacing in the diet the various elements in the composition of rice which are not found in cassava.

135. Sometimes it may be desirable to sacrifice a little energy in order to obtain more of the accessories. For instance, it may be desirable to encourage the growing of a somewhat lower-yielding type of yellow maize in place of a higher yielding white variety simply because the greater value of the accessory factors in yellow maize more than makes up for the loss in the total yield of energy.

136. It should be a principle of policy that the energy requirements should be met out of the most varied possible supply of foodstuffs. On the one hand, as we have already stated, certain foodstuffs in conjunction have a supplementary action on one another, and on the other hand even apart from this factor the greater the variety of foodstuffs consumed the smaller the chance of there being a serious deficiency in any essential requirement.

137. The first and most obvious way of securing diversity is that additional staple food crops should be introduced. This practice is of value from the point of view of agricultural technique since it makes for diversified farming and provides to some extent an insurance against the failure of any one crop. Sometimes also it may make for a better distribution of labour throughout the year. The nutritional benefits are

important also. Thus, where ordinary potatoes or sweet potatoes (especially the coloured varieties) are used in place of some cereal, a valuable increase is obtained in the consumption of important mineral salts, vitamins and proteins. This increase while small in amount, may have a marked effect in improving the value of the diet.

138. The supplementary action of different elements of the diet in combination with one another is a consideration to which weight should be given. Thus as we have pointed out in Chapter III the proteins of mixed cereals and legumes when consumed together have been found to have a marked supplementary action. One of the best combinations from a nutritional point of view is maize, millet and soya bean. Peas and maize, wheat and maize, wheat and peas are other good nutritional combinations. Whether they are also practicable or desirable agriculturally must of course depend on local circumstances.

139. From the point of view of nutrition a combination of cereals and legumes is strongly to be recommended. There are a number of legumes, the addition of which to the diet will be of value in this way. In general while they will not completely make good the defects of a diet composed largely of cereals, they are good sources of protein and in some instances are richer in calcium than cereals. They are also good sources of vitamin B<sub>1</sub> and are of particular value for this reason in combination with starchy foods.

140. Amongst the members of this group the soya bean and the groundnut may be mentioned as being worthy of special consideration. They both contain protein of good biological value and a high proportion of fat. The groundnut contains between 20 and 30 per cent. of good protein and as much as 40 to 50 per cent. of fat. The soya bean is particularly rich in calcium and the groundnut in vitamin B<sub>1</sub>. The soya bean in its fresh green state also contains vitamins of the B complex and the precursors of vitamin A and in this respect, as in its protein, fat and mineral content, compares favourably with most other vegetables. In the dried form, the bean serves as the basis for the preparation of a great variety of dishes.

141. Both crops are thus of outstanding food value and increased consumption of them would be valuable in almost all parts of the Colonial Empire. Groundnuts are already fairly widely grown but their use could be extended and they could be encouraged as an alternative staple crop. The soya bean is unfortunately not an easy crop to establish, and though in certain cases satisfactory crops have been raised, considerable experiment will generally be necessary before it can be successfully established over a wide field. Inoculation of the seed before planting will often be necessary and it is possible that



the system of growing soya beans for two or three successive seasons on the same land will result, as has already been found to be the case in some areas, in increasing crop yields year by year. When it is introduced, it is important that adequate instruction should be given in the methods of handling and cooking its products, for otherwise it will not be used to the best advantage and will fail to become popular\*.

142. In addition to the soya bean there are other legumes which are of special value as foodstuffs. Mention need only be made of pigeon peas (*Cajanus cajan*) an important pulse crop in many parts of the tropics, cow peas (*Vigna unguiculata*) of which there is a great variety in Africa, black and green grams (*Phaseolus mungo* and *Phaseolus aureus*), tepary beans (*Phaseolus acutifolius*) lima beans (*Phaseolus lunatus*), dolichos beans (*Dolichos lablab*) and haricot-beans (*Phaseolus vulgaris*). In cooler climates, such as those of Mediterranean territories, wood beans (*Vicia faba*) are a pulse crop of importance. Many of these can be grown either as a garden vegetable crop for the sake of the tenderpods or "seeds" or as a field pulse crop. The leaves of some of them can also be used as a spinach. Thus in parts of Uganda the leaves of *Vigna unguiculata* are employed.

143. Besides the introduction of additional staple crops there are of course many other ways of introducing variety into the diet. Where a diet is and may have to remain predominantly vegetarian, the chief deficiency may well be in calcium, and amongst the plant products green leafy vegetables alone furnish a satisfactory means of repairing this deficiency. They have therefore a special importance in Colonial nutrition. Moreover, the green leaves introduce into the diet most of the other food factors of protective value; their protein, though small in amount, exercises a supplementary effect, and they help to make a diet more appetising. Green vegetables, it is true, have the disadvantage, at least for the feeding of young children, that they increase the bulk and hence decrease the digestibility, but

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\* The products of the soya bean include the sprouted bean and a preparation obtained by the process known as wet grinding called a "milk." This preparation is of use not so much for consumption in this form as in the manufacture of soya bean "curd." This curd, at least in the form obtained from one method of preparation, is rich in calcium derived from the gypsum or other calcium salt used in the curdling process. In skilled hands it can provide a basis for an extensive series of dishes of the most attractive kind. A range of "cheeses" and "jams" can be prepared by fermentation and by the growth of appropriate moulds on the curd. Another fermented product obtained from the soya bean is a sauce which is very popular in the Far East. Soya bean oil can be used for cooking. It is usually obtained by pressing. There is evidence, however, that when this method is used unsaponifiable matter, probably including accessory food factors of the vitamin A group, is left behind in the press cake.

this disadvantage is very small when compared with the many advantages that will result from increased consumption of them.

144. It is commonly held that green vegetables are of value as a source of iron in the diet. It is indeed true that they are found by chemical analysis to contain a considerable quantity of iron, but it is doubtful how much of this iron is normally absorbed from the alimentary canal. This is one example of the danger to which we have referred in an earlier section of assuming that the chemical analysis of a foodstuff necessarily gives an accurate index of its nutritive value.

145. An important point in regard to the value of green leafy vegetables as a source of food is their perishable nature. Experiment has confirmed that with wilting and injury such as occur in storage and transit there is a marked and fairly rapid loss of vitamin C and the precursor of vitamin A. It is therefore desirable that this class of vegetable should be eaten wherever possible shortly after removal from the ground. It is evident that from this point of view alone the value of home production is great. As we show elsewhere, there are many other reasons, social as well as nutritional, for which we regard it as important that as large a proportion as possible of foodstuffs should be grown by the people who consume them.

146. The range of the green leafy vegetables is wide and varied. There is much concerning their nutritive value which is still quite unexplored. In the case of wild plants used as relishes or side dishes even botanical identification is a matter of doubt and dispute. Lettuce takes first place as a salad plant. It can be grown at almost all altitudes in the tropics. If its use uncooked is considered undesirable, it may be boiled and used as a spinach. Attention may also be drawn particularly to the brassicas including cabbages, cauliflowers, Chinese cabbages and kales. Mention should be made also of amaranths, colocasias, the young shoots of cucurbits and numerous other spinaches. Lucerne, which is of great value in stock feeding can also be made into a very appetising human food if picked young and cooked rapidly in oil or fat. It is particularly rich in protein and has a good content of vitamins, calcium and iron.

147. Besides the legumes and green leafy vegetables there are a number of other vegetables which are also worthy of special mention on account of their nutritive value. These include various tubers such as yams and potatoes. The Irish potato is rich in mineral salts and protein; it contains also vitamin C. The red-fleshed and the yellow-fleshed sweet potatoes are good sources of the precursors of vitamin A and also contain some vitamin C.



148. Carrots, radishes (especially the summer or Eastern types), turnips, kohlrabi, beet, onions, tomatoes, egg-plants, cucurbits, ladies fingers, capsicums and many other vegetables have a nutritional importance which is out of proportion to their value regarded merely as sources of energy. Again, there are many vegetables, such as peppers, shallots and herbs which, besides having a high intrinsic food value, play a valuable part in stimulating appetite and may for this reason be important elements in the improvement of a dietary. In fact there is hardly a vegetable the addition of which to the diet would not greatly improve it.

149. Fruits are in many instances of outstanding importance as sources of vitamin C. There is indeed some evidence that an adequate intake of vitamin C can only be obtained in an ordinary diet of fruits are included in it. In addition they contain mineral salts and the precursors of vitamin A; it is worthy of notice that the skins of some fruits are often particularly rich in this last respect. In tomatoes, for example, the skin contains some twenty to thirty times as much of the precursors of vitamin A as the flesh. It is however indigestible and nothing like all this value is obtained by the consumer. Attention may be directed to citrus fruits (pomelos, grape fruit, oranges, tangerines, lemons and limes) and to papayas and pineapples as rich sources of vitamin C; to mangoes, papayas, dates, tangerines and peaches as sources of the carotenoid precursors of vitamin A and to cape gooseberries, oranges, raisins and figs as good sources of vitamin B<sub>1</sub>.

150. Edible fungi and seaweeds are valuable on account of their mineral content. They can be preserved by drying without sustaining any loss to their nutritional value. Some of them have the added virtue that they contribute to the flavour of dishes in which they are contained. There are also a number of nuts suitable for inclusion in the dietary which contain proteins of high biological value. These nuts are also useful sources of certain mineral salts and in some instances are quite rich in vitamin B<sub>1</sub>. We have already referred to the special value of groundnuts when dealing with legumes.

151. Oil seeds of all kinds are also important because of the bearing which they have on the supply of fats. In the circumstances of the Colonial Empire the special nutritive value of fats and oils lies largely in their content of vitamin A and its precursors. Amongst many Colonial peoples there is a great need for a vegetable oil rich in this respect. In West Africa a vegetable oil of outstanding value and a source of the precursor of vitamin A has long been in use and is now being developed in other parts of the Colonial Empire. This is red palm oil, obtained from the fleshy pericarp of the fruit of the oil palm,

*Elaeis guineensis*. The nutritive value of red palm oil so far as vitamin A is concerned is equal to that of a good cod liver oil. No serious loss of potency results from its use in cooking. A point of great importance however concerns the manner in which the oil is prepared. The nutritive value of the oil is associated with the pigments which give it its red colour, and if these are removed by bleaching as sometimes is the case the oil loses most of its special nutritive value.\* From the point of view of nutrition the qualities of the unbleached red palm oil are unique and in our view the Governments of those territories where the soil and climate are suitable for the growth of the oil palm should do all they can to increase its use.

152. In the sugar-growing territories there is a considerable consumption of the sugar cane in its raw or semi-manufactured state. In recent reports it has been common to assume that beyond being a source of energy sugar has little nutritive value. This conclusion applies of course to sugar in the refined state and we have thought it might be useful to Colonial Governments if we examined in some detail the nutritive value of other forms of sugar products. Accordingly we attach as Appendix 5 a memorandum by Dr. F. C. Kelly on this subject. It will be seen that sugar-cane syrups and molasses may be useful sources of iron, but that otherwise apart from their carbohydrate value they appear to have little nutritional significance and when consumed to excess may be positively harmful.

#### (b) ANIMAL HUSBANDRY.

153. In those territories where it is at all practicable we are sure that great nutritional value is to be derived from increasing the consumption of animal products. Here, as in the case of many other commodities which we have mentioned above, the requirements of human nutrition and of improved agriculture go hand in hand, and increased attention to animal husbandry will often be as valuable agriculturally as it is nutritionally. Wherever it is at all practicable, the introduction of animal husbandry into a system of mixed farming is most desirable from an agricultural point of view if soil fertility is to be maintained. Even if the populations of Colonial territories were able to afford artificial manure in any quantity it would be futile to rely upon its use over any long period unless the rotation provided also for the incorporation of waste vegetable refuse into the soil. If soil structure and fertility is to be maintained, farmyard manure is essential where, as is normally the case in the Colonial Empire, vegetable refuse or compost is not available. Of the nutritional value of animal products, there can be no doubt, provided that the cost of obtaining them

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\* See further on this point Chapter IX, paragraph 226.



is not too great. It may often happen that it is easier to provide good class proteins from vegetable sources than from animal sources, but there can be no doubt that if animal products are available they are a most desirable addition to any diet, and of course animal products provide other constituents of dietary value besides protein. We therefore regard the increased consumption of them as very desirable in almost every part of the Colonial Empire, provided that purchasing power is not thereby unduly diverted from other forms of food and that the animals do not consume an undue quantity of cereals and other foodstuffs which would otherwise be available for human consumption. As we have pointed out earlier on, a considerable loss of energy value occurs in the conversion of cereals, etc., into animal products, and where the energy value of the average human diet is apt to be low this is a factor which must not be left out of account.

154. *Cattle*.—Increased use of cattle in a system of mixed farming is so desirable, both agriculturally and nutritionally, that it will, we feel sure, occur. At the same time there are plenty of difficulties to be overcome. Tsetse fly at present limit the possibility of development over large parts of Africa, though there are some kinds of local cattle which possess a degree of immunity to trypanosomiasis. Animal diseases, particularly rinderpest and bovine pleuro-pneumonia are often very prevalent and droughts may periodically cause the death of large numbers of cattle. There are few parts of the Colonial Empire which can be regarded as well suited for dairy farming according to Western standards. Kenya, Jamaica and Northern Rhodesia offer the most promising possibilities, and in one or two other Dependencies the production of milk for supply to urban areas is making some progress, but with these exceptions dairy farming as it is understood in Europe is unlikely to be profitable in the Colonial Empire.

155. Moreover, cattle are often not put at present to the fullest economic use. In Malaya and in parts of Ceylon they are usually kept not so much for consumption or to provide milk as for draught purposes and for cultivation work in connection with the rice industry. Where they can be kept in Africa they usually range at present over large areas of relatively sparsely populated grassland country and are not associated intimately with agricultural activities. They are regarded as valuable not primarily because they or their products can be consumed as food but because they are a mark of wealth and social status. More often than not the milk is not consumed nor is it converted into such products as curds or ghee, while the meat is consumed only at great feasts or when an animal dies. Quantity is prized more than quality, with the result that parts

of the country become overstocked with cattle which serve no economic purpose, except that they provide a reserve against famine. Overstocking not only with cattle but also with goats causes soil erosion and a vicious circle sets in, which it is very difficult to break.

156. This problem is one which has long exercised the minds of Colonial Governments in parts of Africa, and various remedies are being attempted. In Kenya it is hoped that the economic value of their animals will be brought home to some of the cattle owners by the meat factory which has recently been erected by private enterprise to manufacture various grades of meat products. Difficulty has been experienced in the initial stages in obtaining the cattle, but the hope is that this difficulty will be overcome. We trust that a market for the products of the factory may be found internally, for there are plenty of tribes in Kenya whose diet is greatly deficient in those constituents that meat products could supply. It is indeed often the case that a tribe may be rich in cattle but their diet very low in proteins. The meat factory may do something to reduce overstocking but it will not by itself touch the problem of under-consumption.

157. Equally important in our view is an increase in the number of butchers' shops in Kenya as in many other African territories since these will assist in the solution of both problems, overstocking and under-consumption of animal products. There has already been a considerable increase of meat consumption in Uganda largely through this means. The provision of stock routes to facilitate the movement of cattle on the hoof from areas where there is a surplus to areas where there is a shortage has also resulted in substantial increases of meat consumption in West Africa and elsewhere.

158. Hand in hand with attempts to develop the use of cattle for slaughter should go attempts to improve the trade in hides and skins. The curing of hides and skins has been greatly improved in recent years, but there is plenty of room for further improvement, which will result in a better return to the stock owner. The more lucrative it becomes to export hides and skins, the more cattle will be slaughtered and the more meat will become available for local consumption. It may also be possible to stimulate the economic use of cattle by increasing milk yields, by production of ghee and by encouraging in other ways the use of milk products; we return to this question in paragraphs 164-173. A more thorough study of pasture management is also required in some of the African dependencies.

159. *Buffaloes* can play in the wet tropics an important part in supplying milk, curds or butter. The people should be encouraged to keep good milch herds of buffaloes in those areas in which they will thrive.



160. *Sheep* exist in many Colonial Dependencies. In Cyprus the local cheese supplies are made from sheep's milk, while in several highland parts of Africa and in the Falkland Islands they are kept for the production of wool. Hairy sheep occur in other places but they are not so hardy nor do they increase so rapidly as do goats. Wherever the keeping of sheep is practicable it should be encouraged, but except in one or two territories it is not likely to contribute materially to a solution of the nutrition problem.

161. *Milch goats* may have greater possibilities. The goat is a most destructive animal where it has been allowed to increase in large numbers and to roam uncontrolled over the countryside. The damage which can be done by it is to be seen in many Colonial Dependencies. Milch breeds, however, if kept tethered, might prove to be most valuable from a nutritional point of view. The goat is hardy and is not particular as to its diet. While its milk may convey certain diseases such as undulant fever (as in Malta), it is not liable to be contaminated with tubercle bacilli. It is an animal which is well suited to the means of the peasant farmer, e.g., in the West Indies, and can be tethered to graze on any spare piece of land. We believe that the tethered milch goat may assist considerably in remedying the deficiencies in first class animal protein in certain areas.

162. *Pigs* are a considerable element in the economy of various parts of the Colonial Empire—the West Indies, parts of West Africa, Kenya (for European consumption) and Malta. The pig is chiefly valuable in that he consumes surplus or refuse which could be put to no other use. Among the Chinese in Malaya, for instance, the keeping of pigs is associated with market-gardening and the production of tapioca. The pigs are fed on the refuse from the tapioca factories and their manure is largely used by the market gardeners. From a nutritional point of view, the pig constitutes a valuable source of animal protein and fats and, though no meat is rich in vitamin B<sub>1</sub>, pork contains more of this vitamin than other meats. Where, therefore, there are products which are at present wasted, increased production of pigs may be very beneficial from a nutritional point of view. Where, however, products have to be specially grown for pig food, the advantage is more doubtful. From the point of view of the community as a whole we should regard it as very undesirable that any of the scanty supply of milk products—such as skimmed milk—should be fed to pigs. It should be possible to find more valuable uses for them.

163. *Poultry* may also be a very valuable source of proteins for much the same reason as pigs; they may be kept by anyone with a few square yards of land, they eat food that would otherwise be wasted and they require no great capital expenditure.

We suggest that Governments should do all they can to encourage the keeping and economic use of poultry. Considerable attention has been given to the subject recently in some territories. Unfortunately it often happens that according to local custom eggs are not regarded as a suitable form of food or that through poverty such eggs as are produced are sold in the nearest town. Government should, we suggest, do their best to overcome these prejudices and difficulties and to provide for the investigation and control of poultry diseases which not infrequently occur in epidemic form.

### (c) MILK AND MILK PRODUCTS.

164. Milk is of such outstanding value for human nutrition, especially in infancy and childhood and during pregnancy and lactation, that it seems desirable to devote a special section to the subject.

165. As we have already said, the consumption of milk or milk products in any form is, in all but a few parts of the Colonial Empire, very small indeed, and in many cases no milk is consumed at all. We have recommended in the previous section that increased attention to animal husbandry is most desirable, and the improvement of the milk yield of native stock has been shown to be readily possible by selection and improved breeding. Nevertheless, the fact must be faced that consumption of milk and milk products in anything like the quantity normally regarded as adequate by European standards must remain impracticable for many years to come. We proceed to consider in this section the form in which the meagre resources available may best be utilised, whether those resources are derived from local production or from imports.

166. As has been seen milk and milk products may of course be derived not only from the cow but from other mammalian animals as well. In some parts of the Colonial Empire, for instance in Malta, the goat is a more important source of fresh milk than the cow, and elsewhere buffaloes are used. They give a milk very rich in fat. In some territories camel's milk is drunk and in others sheep's milk is used for making cheese.

167. Unfortunately fresh whole milk, besides being the most valuable of all foods, may also be one of the most dangerous. It is at all times a medium through which disease may be conveyed to man either through the transference of disease from the animal itself or through the introduction of impurities into the milk between the time it leaves the animal and the time it is consumed. Even in European conditions it is a matter of great difficulty to ensure purity of the milk supply, and in many primitive communities it would be almost impossible. It would be extremely difficult to supervise production and distribution



except with unwarranted cost, and in the tropics once milk has become contaminated the bacteria increase even more rapidly than in a temperate climate. Where fresh milk is of poor quality or much contaminated, it is certain that either condensed or dried milk of good market quality and protected from contamination in use is preferable.

168. It is of course conceivable that local milk supplies might be preserved by some form of heat treatment. Conditions have to be very favourable before a condensed milk factory has much prospect of success. A scheme for one is now, we understand, under consideration in Jamaica where conditions are as favourable as in any part of the Colonial Empire. The possibility of producing condensed milk in Kenya might be worth examining. Elsewhere it is possible that more simple arrangements for the heat treatment of milk suited to Colonial conditions could be devised. The subject is well worth investigation.

169. A certain amount of the local supply of milk may be turned into butter or ghee, that is, clarified melted butter; there has been a substantial development of ghee manufacture in recent years in many dependencies. This use of the liquid milk at least ensures the consumption of fats and some part of the other constituents of milk without danger to health, but from the point of view of the community as a whole it is wasteful of the scanty milk supplies unless the skimmed milk which remains is also used. In East Africa, however, where the production of ghee has been encouraged, it has been found that with the provision of an economic outlet for the cream the people to whom the skimmed milk has been returned have started to consume it, whereas previously they were disinclined to milk their animals at all. Contrary to a general belief butter is by no means the most valuable constituent of milk. It contains only the fats of whole milk, vitamin A and small quantities of vitamin D. Quite as valuable is skimmed milk, which stands next to whole milk in the order of the nutritive value of foods. Apart from the fat and its attendant vitamins A and D, it seems to contain all, or practically all, of the remaining materials required for the nutrition of the body, and if it is wasted there is a serious loss to the community.

170. Milk on turning sour clots and forms curds, the watery residue being known as whey. Curds play an important part in nutrition in several provinces of India, and there seems room for considerable development in the use of them in the Colonial Empire. They are already by no means unknown. Curds contain practically all the fat of whole milk with its attendant vitamins A and D, the bulk of the protein, much of the calcium and phosphorus and appreciable quantities of most of the other

constituents of whole milk. It possesses the important advantage over liquid milk that it can be kept for longer and is less liable to contamination.\*

171. Cheese, which is manufactured out of the curds by pressing out such whey as remains in it, is also a foodstuff of great value which can be kept for considerable periods. It is particularly useful as a very rich source of first class protein. Usually, however, tropical peoples prefer liquid curds to hard cheese.

172. Whey, which contains the balance of the constituents of whole milk not in the curds, should by no means be wasted. Its protein and mineral elements and the B and C vitamins make it quite a valuable food which would add considerably to the nutritional value of a diet consisting largely of cereal products.

173. In general attention should be directed towards the production of those milk products which are suited to the tastes and requirements of the people and the conditions under which they live rather than to the development of a dairy industry on the lines familiar in this country. This point has been well brought out by a recent inquiry into the dairy industry of India.

174. We come now to the possibility of imports. Imports of milk and milk products are considerable per head of the population in Malaya and some of the West Indies, but are negligible in most other territories. We consider it very important that all Colonial Governments should remove all import duties on milk and milk products. This recommendation is subject only to two qualifications. In the first place there may be treaty obligations which preclude the total abolition of all duties. Secondly, the interests of a local dairying industry may have to be taken into account. We think, however, that it is very seldom that imports of dried or condensed milk would have any adverse effect upon a local dairying industry. They are not in general likely to compete with fresh milk, for such fresh milk as reaches the towns (where the majority of condensed milk is sold) is usually a luxury article meeting a different market. Nor are they likely to affect consumption of other milk products. While we do not wish to be too dogmatic on the subject, it seems to us likely that the only instance in which imported dried or condensed milk might be harmful to a local industry would occur if there were a question of setting up a local condensed milk factory.†

175. We feel, however, that even if all import duties are removed on milk and milk products (and in some cases there are

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\* See also Chapter IX, paragraph 228.

† See also on this subject Chapter X, paragraph 258.



none already) imports will still remain too expensive to provide a solution of the problem or, in most territories, to go far towards that end. Indeed, they may often be so expensive as to be positively harmful by diverting purchasing power from cheaper foodstuffs available locally. Although these local foodstuffs have not, weight for weight, the same nutritive value as imported milk products, the larger amount that can be purchased with the small cash resources of the average consumer may on balance give him better nutrition. It is important that nutritive value should always be assessed in conjunction with cost.

176. At the same time imports of milk products may be exceedingly useful. In some territories imports of condensed milk are already considerable, and it seems to us that there may be real use for bulk imports of dried skimmed milk for feeding to selected groups such as school children or labourers. Imports of dried skimmed milk might be practicable when fresh milk is not available or is far too expensive.

177. We attached as Appendix 3 to this report a memorandum in which it is sought to discover the most economical way, from a nutritional point of view, of spending a given sum on the purchase of manufactured milk, taking into account also the consideration of possible deterioration between manufacture and consumption. Prices vary so much from place to place and from time to time that exact conclusions are not possible, but the following broad general conclusions emerge:—

(1) Of the various types of manufactured milk, the real choice lies between condensed sweetened whole milk and dried skimmed milk. As regards keeping qualities, condensed sweetened whole milk is more convenient for household use, but dried skimmed milk is just as suitable, if not more so, for use in institutions or for the supplementary feeding of groups of the population, e.g. school children.

(2) £1 spent on condensed sweetened whole milk, or indeed on any form of whole milk, will purchase considerably more fats and vitamins A and D than £1 spent on any form of skimmed milk.

(3) But £1 spent on the purchase of dried skimmed milk will give a very much larger quantity of proteins, calcium, phosphorus, iron and the B vitamins than £1 spent on condensed sweetened whole milk or any other form of processed milk.

In other words, in everything except fats and vitamins A and D dried skimmed milk has very considerable economic advantages in the Colonial Empire over other forms of milk, at any rate for use in bulk. We recommend that its use should be greatly extended. It is true that no form of skimmed milk is suitable as a sole food for infants and if it were available

for general consumption the risk of its use for this purpose would have to be set off against the advantage to the general population of increased quantities of protein, calcium, etc. We think that the risk is one which might often be taken. Moreover it is also true that condensed whole sweetened milk is not by any means an ideal food for infants, because the large quantity of sugar it contains replaces Calories that should be obtained from more valuable foods containing fats, proteins, etc.

178. The conclusion that dried skimmed milk may be exceedingly valuable has already been reached in India, where steps have recently been taken to remove all duties on it and where it is now recommended for use for the supplementary feeding of schoolchildren and in other Government institutions. We would make the same recommendation as regards the Colonial Empire. We think that increased imports of dried skimmed milk for large-scale use might be of great significance in most parts of the Colonial Empire particularly in remedying protein deficiencies.

179. In a few territories it may not be possible to remedy the serious deficiency of fats without the use of some form of whole milk. Generally however it should be possible to supply the fats from other sources and the cost of so doing should not detract very materially from the advantages of dried skimmed milk in other respects.

#### (d) FISH.

180. Fish can contribute a number of constituents which are of importance to the dietary. In particular its proteins may be very valuable indeed. Fish oil, fish livers and "fat" fish such as herring and salmon are also rich in vitamin A and small fish entirely consumed give calcium and other inorganic elements. In addition sea fish are an important source of iodine. In short, they are a most valuable foodstuff and we regard it as most important that the supplies of fish in and around Colonial waters should be developed to the maximum possible extent. The river, sea and lake resources of fish in the Colonial Empire are still largely undetermined and we recommend that increased attention should be given to this matter.

181. In some Colonial territories a beginning has already been made. Ceylon, Malaya, Mauritius and some of the West Indies have for many years devoted attention to the subject. More recently Palestine, the Gold Coast and Zanzibar have been endeavouring to stimulate their sea fisheries, while surveys of the lake fisheries have taken place in Uganda and other parts of East Africa.

182. The possible types of fishery are three, (i) inland fisheries, both river and lake, (ii) inshore sea fisheries and (iii)



deep sea fisheries. In the first two cases development can probably best be carried out by the local inhabitant with little capital and equipment, but technical advice will be necessary both as to the fish resources which exist and as to the best means of exploiting them without depleting them. In the case of deep sea fisheries larger capital and equipment will normally be necessary, and it will not be attracted until it has been shown by expert survey and experiment that fish are available in paying quantities. We believe that much useful work might be done by some central organisation to advise and assist Colonial Governments on all these matters and we are very glad to learn that at the instance of the Secretary of State for the Colonies it has recently been decided to set up a Committee in London to assist in the development of colonial fishery resources.

183. It should be borne in mind that there are differences of great significance in the amounts of the various constituents present in different varieties of fish. This is particularly true in regard to the fat content which may vary from approximately 0.5 per cent. to more than 10 per cent. It is also important to appreciate that the offal of fish is particularly rich in accessory food factors and that these are lost where, as is usual, fish are eaten after having been gutted. With fish the problem of preservation and distribution must necessarily be an obstacle to more widespread consumption. We return to this question later.

#### (e) CONCENTRATED FOODSTUFFS.

184. In the previous paragraphs we have made a number of suggestions as to the kind of crops and animal products which should be encouraged for the sake of improving nutrition. In general we consider that it should be the aim of nutrition policy to rely on natural foodstuffs for the improvement of diet. Circumstances may, however, arise in which certain groups (i.e. school children, hospital patients, labourers on estates and mines and in urban areas) may benefit from the distribution of highly protective foods in concentrated form, provided that these can be obtained cheaply in large quantities.

185. Manufactured milk, for instance, might be used in this way for school children and hospital patients. We have discussed in paragraphs 176-179 the most convenient and economical form in which to give it. Yeast is another substance which might also be used. As has recently been pointed out by a Sub-Committee of the Technical Commission on Nutrition of the Health Organisation of the League of Nations, it is rich in nitrogenous elements and in the B group of vitamins. It is of particular value in correcting deficiencies in diets composed largely of cereals. Methods by which yeast rich in water-soluble vitamins can be produced cheaply on a large scale in countries where cereal diets are general are certainly worth investigation.



186. Yeast extracts and autolysates are often given to assist in remedying specific deficiency diseases such as beri-beri. The proprietary articles are, however, too expensive to be used on a large scale. We think that Colonial Governments would do well to consider whether it would not be practicable to produce locally a concentrated article of similar nature which would be much cheaper and could therefore be more widely used. Thus, in Hong Kong, an extract of yellow beans (*Glycina soya*) and rice polishings is now given in cases of beri-beri in place of marmite and seems to give considerable benefit. In general rice bran or polishings is a valuable article which should not be wasted.\*

187. There is little doubt that the local "beers" which are frequently found and largely consumed have great nutritional significance, providing vitamin B complex (in the yeast), vitamin C (from germinated grains) and probably other valuable constituents. The use of these beers in moderation thus undoubtedly has certain benefits from the nutritional point of view, whatever may be the other objections to it. In South America beri-beri has been shown not to exist in areas where local beer brewed from cereals is consumed. Again, it might be practicable in certain territories to supply vitamin deficiencies by such means as the local production of fish liver oil. This too is a matter which is worthy of investigation.

188. Similarly, as the Sub-Committee mentioned above have also pointed out, mineral elements can sometimes be supplied in concentrated form. Calcium salts, iron, iodine, etc., can be supplied cheaply to school children and other groups suffering from deficiency of these elements. Such a measure may be financially feasible when expense forbids the supplying of milk or other valuable foods. For instance it has been shown that one of the most important defects of the poor rice eater's diet is a deficiency of calcium. In such circumstances the regular provision of a calcium salt would do something to raise standards of nutrition. The same measure may be effective in the case of people living on other staples, for instance cassava (or tapioca), which are deficient in calcium. Prepared bone meal or flour has also been suggested as a source of calcium phosphate.

189. In some territories it would be useful if attention were given to the sources of supply of salt. Local sources are often capable of development and improvement and, where imports have to be relied upon, steps might be taken to ensure that the salt imported contained a minimum percentage of calcium, iodine and perhaps iron. We commend this suggestion to the attention of Colonial Governments.

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\* We deal with questions relating to the processing of rice in the next chapter.



## CHAPTER IX.

THE HARVESTING, PRESERVATION, STORAGE,  
PROCESSING AND COOKING OF FOODS.

190. As we have already pointed out, there are many factors affecting the nutritional value of a foodstuff. In this chapter we propose to deal with the sequence of events that foodstuffs pass through between harvesting and consumption, omitting however questions relating to marketing and transport, which we shall deal with in the next chapter.

## (a) HARVESTING.

191. The chemical composition of any crop is obviously very different at early stages of growth and at maturity, but less noticeable though perhaps as significant are the changes during the period of actual ripening. Alterations in the relative proportions of carbohydrate and protein or of fat and protein then take place, and in the case of grains and seeds, while the water content is progressively reduced, the relative insolubility of the foodstuff is increased. The vitamin C content of a crop also is directly related to the age and activity of the plant tissues. In the majority of cases ripe fruit contains more vitamin C than unripe fruit. Young growing shoots of spinach, lucerne and amaranth are richer in vitamin C than old leaves and stems of the same plants. Similarly, young green peas are richer in vitamin C than older peas.

192. The treatment of the crop in the field may also affect nutritive value considerably, especially as regards vitamins and vitamin C in particular. The vitamin C content of a vegetable, for instance, rapidly diminishes as the crop becomes stale. Cut greens as they wilt lose their vitamin C very quickly and the precursors of vitamin A are also oxidised and lost. Green peas may lose 50 per cent. of their vitamin C in as short a period as 48 or even 24 hours after picking. In the same way, the vitamin C content of potatoes is highest immediately after harvest and gradually diminishes during storage. In general, perishable vegetables should be consumed as soon as possible after collection, or if they are to be kept for future use they should be stored or preserved as soon as possible.

193. Somewhat similar considerations to those just set out apply to animal products. The nutritive value of a fish, for example, varies according to its maturity and age, its food value being highest immediately before spawning and lowest after spawning.\* As regards the vitamin content of the livers, if the cod can be accepted as typical, the larger the fish of a given species from a given locality, the greater the proportion of vitamins in its liver-oils. The time between death and consumption or curing also affects the nutritive value of a fish. The flesh of fish is extremely perishable; the flavour is quickly lost, the texture deteriorates, the appeal to the appetite disappears and the flesh decomposes.

#### (b) PRESERVATION AND STORAGE.

194. Where immediate consumption of any perishable food-stuff is not possible it must be stored or preserved in some form or other, and it is important that a method of preservation should be adopted which will involve the minimum loss of nutritive value. This question of the preservation and storage of food is one to which a great deal of attention is now being paid in some European countries and in the United States of America. Investigations relating to produce grown under tropical conditions have so far been limited chiefly to fruit and vegetables for export. Valuable results have been obtained from this work and it is to be hoped that it will be continued and extended. It has, however, little direct relation to nutritional problems in the Colonial Empire.

195. From that point of view the main problems are not associated with large scale storage or with the preservation and storage of high grade commodities for overseas markets. Rather they concern storage by the individual or the small community from one harvest to the next of the crops that they themselves grow and keep for their own consumption and the preservation of highly perishable products such as fish, soft fruits and green vegetables so that they need not be consumed at once but can be kept for a while and if necessary distributed over a wider area. Many indigenous systems have been evolved and many of these are sound, effective and economical. The Chinese in particular have invented many ingenious forms of processing and storing their food.

196. We suggest that steps might be taken to collect together information regarding existing practice in the Colonial Empire and the points on which it is felt locally that there is room for improvement. The information thus obtained could then be collated for general circulation. The subject is important

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\* Obviously, however, if there is any chance of a depletion of the stock it is not to be advocated that fish should be caught when they are just about to spawn.



for there is no doubt that the losses due to faulty storing and the absence of proper methods of preservation are in many areas considerable and that much could be done by more effective methods to improve nutrition in those areas. It is of particular importance in those territories where there are seasonal shortages of food and the possibility that the staple crop may fail.\* We hope that the survey we have suggested will also cover the various forms of preserving fish.

197. In a sense all forms of storage are only a second best. The ideal is that supplies of fresh food should always be available in succession. The homestead garden is the perfect store for green vegetables, as is the orchard for fruit and the lake, pond or river for fish. These three classes of foods, green vegetable, soft fruits and fish, are much more perishable than seeds, root crops and the hard fruits, and moreover important food values are lost in proportion to the time which elapses between their collection and their consumption at the table. However, storage and preservation must normally be resorted to. Indeed, it is essential where there is an alternation of gluts and famines and where an all the year round succession of fresh foodstuffs does not occur.

198. Food can be preserved in a large number of ways: by physical methods, such as cooling, heating or drying; by chemical methods such as salting, smoking, sugaring, souring, mixture with condiments, the addition of alcohol and other chemical substances; or by a combination of two or more of these methods. All treatments are really designed to prevent or slow down chemical changes in the substances preserved, to destroy or inhibit the action of contaminating organisms and, when these conditions have been reached, to maintain them. The process of drying is employed because the more water that is removed from a product the better it will keep. High temperatures sterilise the products by killing bacteria and fungi and their spores, and so prevent fermentation if contamination after cooling is avoided. Heat also destroys enzymes which would otherwise hydrolyse the fats into fatty acids, whereby the product would become unpalatable. Salt is added because very few bacteria or fungi will multiply in high salt concentrates. The use of hot smoke, which partly dries and cooks the product,

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\* In such territories a communal store may often be useful. Thus in parts of Uganda a levy is imposed on each producer in the community, and this is kept in a communal store. After the levies have accumulated during a period of anything up to four or five years, the producer on handing over his next levy is given in return an equivalent amount from the store containing the oldest grain or seeds. Not only does this communal store provide a reserve which can be utilised in times of famine, but it serves to increase the sense of security, the thriftiness and the foresight of the members of the community.

adds to it also certain organic compounds, which serve as preservatives. Acids and sugars are employed because when present above certain concentrations they create media unfavourable to the growth of micro-organisms, while refrigeration and storage at low temperatures prevent their development. Canning is resorted to because the process involves the sterilisation of the product by heat while the subsequent hermetic sealing of the cans prevents reinfection; the spores of any organisms which may have resisted heat sterilisation are almost invariably aerobic and cannot develop if air is excluded.

199. Of the various forms of treatment, drying is one of the most common. It is the process normally employed for the preservation of grain and it may also be used for a great many other commodities. One of the advantages of dried products, particularly those which originally had a high water content, is their relatively light weight, which makes them easier than most forms of preserved food to transport.

200. The amount of drying required will depend on the nature of the product to be treated. In the case of fresh fruits and vegetables the moisture to be removed is very considerable, amounting often to over 60 per cent. of the weight of the fresh product. It may be removed by drying in the sun as in the case of raisins, apricots, prunes and often (in the tropics) of fish, or by drying in some form of evaporator in which artificial heat is used, sometimes under reduced pressure.

201. The nutritive value of the dried article need not differ greatly from that of the fresh article, except that there will be some loss of vitamins, notably vitamin C. Dried fruits and vegetables have little vitamin C content compared with their fresh counterparts. Conditions of drying affect the matter; the vitamin C content of the dried article will be highest when drying has taken place at a low temperature, and at any given temperature the more quickly the drying has taken place the greater will be the retention of vitamin C. Bruising, peeling, cutting and crushing should also be avoided or reduced to a minimum.\*

202. Drying may also affect the time required for cooking. For instance, it has been shown that beans dried to a zero water content without rupture of the testa still remain hard after ninety minutes' cooking, whereas ordinary commercially dried beans would be softened and cooked in an hour.

203. The successful storage of grain depends on the moisture content being reduced to a satisfactory level and kept at that

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\* Green foods are sometimes partially cooked before being sundried. The principle appears to be sound as the quick heating should lead to a greater retention of vitamin C.



level. The level varies for different crops, ranging between 10 and 14 per cent. The best means of reducing the moisture content depends upon the atmospheric humidity and other climatic conditions; often drying in the field in the sun before threshing presents no difficulty, but where the atmospheric humidity is high special provision may be needed. This may take the form of grain driers in which a current of heated air is forced by blowers or suction fans through the grain, but the older and more general form is drying floors or barbecues on which the grain is spread out and subjected to the direct heat of the sun, usually with provision for covering it up rapidly should rain suddenly occur.

204. Not only, however, must the moisture content of stored grain be reduced to a satisfactory level, but it must be kept at that level during storage. In countries where there is an alternation of dry and wet seasons this is important. Articles which have kept well in months of dry weather may go bad in a few days when the wet season begins. It must also, of course, be kept as free as possible from attack by insects and vermin which at present cause very considerable loss of stored foods in the Colonial Empire. Incidentally grain insufficiently dried is much more liable to insect attack than grain which has been thoroughly dried.

205. Under primitive conditions and where atmospheric humidity is not too high, as in many parts of Africa, maize can be dried in the husk in the field to a satisfactory degree, and it can then be kept still sheathed in the husk in the homes of the growers for moderately long periods in fair conditions. The leaves of the husk will prevent the entry of insects. With other types of grain, e.g. millets or paddy, and with maize when the atmospheric humidity is high, greater precautions are needed. Various indigenous types of granary have been evolved and some of them are moderately efficient. The grain should if possible be stored in airtight containers, either stone jars or iron tanks or tins. Old petrol tins do well for storage on a small scale. In India grain stored in this way has been successfully "sealed" and kept airtight by covering it with a layer of sand, a sheet of cloth or a piece of wood or iron being placed in between to prevent the grain becoming mixed with the sand. On the Gold Coast maize stored in airtight petrol or kerosene tins showed no appreciable loss of weight and was free from weevils after eight months, whereas well-sheathed corn stored in a native barn showed a decrease of 25 per cent. in weight and was of a less attractive appearance.

206. For the large scale storage of grain, specially constructed granaries have been erected in some Dependencies. The rice granaries of Ceylon and Mauritius are examples of such stores.

The most satisfactory method for the bulk storage of grain is in large concrete or metal tanks which can be hermetically sealed and which are also provided with facilities for fumigation in the event of the contents being attacked by insects. Grain is, however, often stored in bags in large stores. It is important that such stores should always be made rat-proof since otherwise a large amount of damage may occur and there is the added danger of providing foci for rat-borne diseases, particularly plague. Grain stored in bags is also much subject to attack by insects. It is very difficult to guard against this, though recent experiments in Malaya indicate that an addition of 5 per cent. of quicklime to rice will prevent weevil attack. In general storage in bags, though for various reasons it may often have to be used, is not so effective as storage in concrete or metal tanks.

207. Indeed as a general rule it may be said that wherever possible stored products, whether dried or not, should be kept in airtight containers. Not only will bacterial and fungal activity thus be reduced to a minimum, but also there will be no danger of attack by insects. If the product is free from pests when sealed in the container it will be free when the seal is broken. If the product stored is living, e.g. grain or seeds, then respiration will take place in the container. In airtight containers, as a result of progressive replacement by carbon dioxide of the oxygen in the air between the stored products, the rate of respiration is progressively retarded. For this reason, and because of the dry environment, the life of the grain is prolonged. At the same time the accumulation of carbon dioxide will first check the activity of any insect pests that may be amongst the grain and then will asphyxiate them.

208. If a container is airtight it will very often be ratproof. If it is not, means must also be found of affording protection against attack by rats, since not only will they cause direct loss but also, by damaging the container, they will permit the entry of damp air and insect pests.

209. If the stored product has to be transported, this should be taken into account. If transport is by head portage, bicycle or lorry, then the type of storage should be adapted to this method. For example, if fish is the commodity in question and head portage or the bicycle the method of distribution, then the storage container employed should not exceed in size one load. This is not always practicable but the principle should be borne in mind.

210. Drying may be accompanied by chemical treatment of the article to improve its appearance and keeping qualities and to conserve its nutritive value. Sulphur dioxide, for example, is employed in California where it is desired to preserve fruit



by artificial drying with improved colour and with a relatively higher water content than in the sun-dried product. Drying is also more readily effected if combined with treatment by sulphur dioxide. This treatment in the case of apricots, prunes and raisins preserves both vitamin A and C, as compared with the sun-dried products where these vitamins are largely lost.

211. Sulphur dioxide must be used with discretion and under supervision. There are however other and more simple methods applicable to special products of combining drying with a chemical process. Fish, for example, besides being simply sun-dried (stock fish), may be salted and dried (dried salt cod), lightly salted and lightly smoked and dried (kipper), salted and dried with heavy smoking (red herring), lightly salted and lightly smoked but in a hot smoke which cooks as well as dries (bloater). The drying, salting, smoking and cooking all play their part in increasing the keeping quality of the fish.\*

212. Brining (not to be confused with brine freezing, an expensive process seldom applicable in colonial conditions) is a useful method of preservation which is applicable to fish, meat and the leaves and roots of vegetables. It is a method much used by the Chinese in Malaya. Brined products have in the past been regarded as of doubtful nutritional value. We consider, however, that the evidence on this point is inconclusive, and that where a poor state of nutrition has been observed to accompany diets largely consisting of foodstuffs preserved in this manner, the explanation may be found in the low nutritive value of the remainder of the diet. It is possible that prolonged brining in the case of certain vegetables results in the formation of toxic substances; this is referred to below. There is recent evidence that the presence of cooking salts prevents the loss of vitamin C from lemon juice. If this finding is confirmed for other foodstuffs it is clearly of importance.

213. Where wet storing is used for the preservation of roots and vegetables, the addition of bran from, say, rice will be found useful in the course of pickling, since by this means vitamin B<sub>1</sub> can be introduced, the vitamin diffusing from the bran into the wet vegetables. The bran used must be fresh, i.e. recently removed from grain which has been stored under conditions in which the vitamin B<sub>1</sub> content has not been lost. There is, however, no necessity for the grain to have been

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\* Salted fish should be kept dry, and where humidity is high this will entail an airtight container. Lightly smoked fish will only keep a few days even in temperate climates, and on ice will only keep at the most for a few weeks. There is evidence to show that in the processes of salting and drying fish practically all the vitamins A and B normally disappear, but it is possible that methods can be devised to diminish this loss.

stored previously in the husk. Since vitamin B<sub>1</sub> is soluble in water, it follows that the volume of the pickling fluid should be kept as low as possible.

214. Smoking is a method of preservation which is particularly applicable to fish. In some parts of the Colonial Empire fish are smoked by primitive methods; the more common method, however, is to dry them in the sun. It seems reasonable to suppose that the methods of smoking at present in use destroy a considerable part of the nutritive value of the fish. There are no specific data on the subject, and it is possible that the condition in which the fish has been kept before smoking may be responsible for this loss.

215. The use of acids in souring products and thereby preserving them is of considerable importance. The precursors of vitamin A, vitamin B complex and vitamin C are all stable in acid conditions. Acids are used in the preparation of pickles, and acetic acid, the acid principally employed, is easily prepared by the action of certain organisms on the alcohol present in beers, wines or a variety of locally brewed drinks. In the pickling of vegetables and fruits in vinegar the same results are achieved, but it should be noted that the water soluble vitamins B and C will be equally distributed in vegetable and pickling fluid, and as the latter is often wasted it should be kept to a minimum volume.

216. Two other preservatives in general use are saltpetre and sugar. Saltpetre is used in conjunction with salt in the curing of meat, and sugars are employed chiefly in the preserving of fruits, either as whole fruits, as preserves or as jams. Salt pork is perhaps the most widely used of the salted meats.

217. A number of recipes for preserving eggs have been devised, in which drying or salting are most general. Sometimes a mixture of salt and the ash of rice husks is used. In another method tannin derived from an infusion of tea, salt, soda, ash, lime and charcoal are mixed to form a paste in which the eggs of hens, ducks and geese are preserved. In East Africa eggs are preserved in a mixture of beeswax and crude simsim oil. Still another device involves the use of salt, rice bran and rice wine. The use of sodium silicate (water-glass) and of other commercial methods is not applicable to native conditions on account of their cost.

218. In the modern world refrigeration is familiar as a means of food storage, and the use of cooled containers assists in the distribution of perishable products. In many parts of the Colonial Empire there are now cool stores in important towns, but for a long time to come they can only have a very limited



effect upon the foodstuffs consumed by the poorer classes. In a few cases refrigerated trucks or vans are provided for the transport of fish, meat or perishable vegetables to central markets. Again, however desirable such a development may be, it can only be of limited utility for a long time to come.

219. Canning is a form of food storage which is much developed now in western countries, and is being developed in certain parts of the Colonial Empire. It is the best method of preserving watery tissues. Canning in the Colonial Empire is at present chiefly for export markets, but a beginning has been made in some parts in canning for local consumption. Locally canned pineapples are consumed in Malaya, and locally canned grape fruit in Jamaica, British Honduras, Trinidad and the Gold Coast. Plans are on foot for a local factory for the manufacture of milk products in Jamaica. Canning for the local market may, it seems, develop considerably in certain parts. On occasion, the imported canned foodstuff may also play an important part in nutrition. Canned foodstuffs have the great advantage that they will keep for a long time, and in tropical countries where fresh foods are liable to more rapid deterioration than in temperate climates this is a factor of importance. For instance, we have already in a previous chapter recorded the view that condensed milk, being of known purity and quality, is from a health point of view preferable to fresh milk of low grade which is often adulterated or contaminated before it is consumed. Certain precautions must be taken in the use of canned foods, for in many instances when the tin is once opened the contents become contaminated by flies or bacteria more quickly than the fresh article.

220. In the circumstances of the Colonial Empire, moreover, there are other considerations which must be taken into account. Chief among these is the relative cost of canned food as compared with the fresh product. Whatever the relative nutritive value of tinned and fresh spinach, if the purchase of the tinned product entails the disbursement of some of the purchaser's scanty cash resources while the fresh spinach requires no cash payment at all, the fresh product obviously has the advantage. Again, as we have tried in an earlier chapter to point out, there are many advantages—social, economic and even nutritional—in persuading as many people as possible to grow their own food.

221. For these reasons the canned foodstuff will never, we think, play as important a part in the economy of the Colonial Empire as it plays in some western countries. At the same time, when there is a known deficiency of an essential element of nutrition which cannot be easily supplied from local foodstuffs, as for instance in the case of milk products, the supply

of canned foods may be the most effective and cheapest means of remedying the deficiency. In such cases they may be of value even in rural areas, and in urban areas their value is naturally likely to be greater.

222. There is a considerable amount of misapprehension regarding the value of canned foods and indeed of stored foods of all sorts. It may therefore be useful if we quote the following statement which has been authorised by the Medical Research Council:—

“ There is still so much to be learnt about food and nutrition that it is impossible, in the present state of knowledge, to state categorically whether or not stored foods are as nutritious as fresh foods. Nor is it feasible to undertake research with a view to answering this question directly. Many years of intensive work on large groups of human beings would be entailed, and even then there would be little prospect of arriving at a definite decision, for, with further knowledge of the effects of dietary factors on nutritional processes, it would be found that the results of the first few years' studies would have to be reconsidered in the light of fresh evidence. Nevertheless, useful information can be obtained by comparing the chemical composition of stored foods with that of fresh foods, and the general conclusion can be accepted that relatively little loss of known constituents occurs in foods stored by modern methods. Moreover, experiments have been carried out on animals in which satisfactory nutrition has been maintained with diets composed solely of stored foods. The available evidence therefore suggests that modern methods of storing foods caused little depreciation in their nutritive value; in fact, it may be said that food of good initial quality that has been stored by the best modern methods is likely to be superior in many respects to similar food that, though still technically fresh, is in reality stale. One substance of important biological significance, especially associated with fresh fruit and vegetables, namely vitamin C or ascorbic acid, is well known to be easily destroyed by heat, applied either in ordinary cooking or canning; to a less extent vitamin B<sub>1</sub> is liable to be similarly affected.”

223. In framing this statement the Medical Research Council refer to “ modern methods of storing ” and no doubt they had canning primarily in mind. Whether the statement would hold good of many methods in use in the Colonial Empire is perhaps doubtful, but while one cannot be too dogmatic, at least it seems that, weight for weight, canned foods are not much, if at all, inferior in nutritive value to food which has not been canned, and may in certain circumstances be superior.



## (c) PROCESSING.

224. It has long been recognised that the processing of foodstuffs may have great nutritional significance. For instance, one of the most striking discoveries ever made in the field of tropical nutrition was the discovery that the removal of the fine covering of the rice grain in the process of milling removed also the nutritive substance, vitamin B<sub>1</sub>, the absence of which in the diet causes beri-beri. Consequently, people who live largely on polished rice and do not supplement the rice with other foodstuffs rich in vitamin B<sub>1</sub> are very liable to suffer from the disease. In the same way, the vitamin B<sub>1</sub> content of even lightly milled rice may be removed if the grain is thoroughly soaked or washed and the water thrown away. The methods of processing, handling and storing rice are nutritionally of the first importance in territories where rice is the staple diet, and they should receive the careful attention of the authorities in those territories. We commend to their careful consideration the valuable memorandum by Dr. B. S. Platt which is attached as Appendix 6 to this report. The memorandum embodies the results of original work and the conclusions set out on pp. 196 and 197 are of much practical importance in countries where rice is the staple diet.

225. In the case of other grains, such as wheat, a high degree of milling also reduces nutritive value. For this reason wholemeal flour is greatly to be preferred to other kinds, especially where the diet is approaching deficiency level. Dependencies which are substantial importers of flour might consider the practicability of legislation to regulate the quality of imports. The question is not, however, of the same order of importance as in the case of rice.

226. In several other cases the normal commercial processes destroy a substantial part of the nutritive value of the article. Such is the case, for instance, with red palm oil, the produce of *Elaeis guineensis*. This in its original condition is very rich in carotenoid precursors of vitamin A, so much so that its use has been proposed as a substitute for cod liver oil or halibut liver oil as a means of administering this vitamin. The act of bleaching for commercial use, however, almost completely destroys the carotene content. Actually in West Africa, the only part of the Colonial Empire where palm oil at present forms an important constituent of the diet, it is used without any bleaching treatment; but it is important that the point should be appreciated, as it is to be hoped that its use will be introduced into other parts of the Colonial Empire. To obtain the maximum nutritive value, the fruit should be collected carefully with the minimum of bruising. The whole fruit should be subjected to steam-heat to destroy the enzymes which liberate

free acids from the oil. The pericarp should then be removed and the oil extracted from it. The oil should then be sterilized by steam-heat. The principle to be borne in mind is that if the oil is broken down at any stage, free fatty acids will be formed and a percentage higher than five per cent. makes the oil unpalatable\*.

227. Some of the processes to which fresh foodstuffs are subjected before consumption or storage may give rise to by-products which are of nutritional value. Reference has already been made to the high nutritive value of bran recently milled from rice stored under good conditions. The example *par excellence* of a by-product which has nutritional value is skimmed milk, which is a by-product of the manufacture of butter or ghee. Another example is the livers of certain fish including many tropical fish, such as sharks, bonito and albacore, which are exceedingly rich in vitamins A and D and in blood-forming substances. In certain Colonies it might be worth while to consider the possibility of setting up plants to enable the oil to be extracted from these livers for consumption in concentrated form.

228. There are many forms of processing which add to the value of the product. For instance in Chapter VIII paragraph 170 we said that curds were a form of milk product likely to be valuable in the Colonial Empire. The reason for this is that in the acid medium of soured milk there is a peculiar bacterial flora in the presence of which many organisms such as those which cause bacillary dysentery, cholera and typhoid, cannot flourish. In a primitive community therefore curds are a much safer commodity to handle than milk in that there is less likelihood of these diseases being spread.

229. Similarly if peas, beans and grain be allowed to germinate, vitamin C is produced in appreciable quantities. An important side-dish of the Chinese consists of the soya bean sprouted in the dark. Indeed soya beans in any form must be properly processed if they are to be readily eaten. We have referred to this in Chapter VIII, paragraph 141.

230. Again, it is now generally recognised that grinding, by assisting digestion, may indirectly increase the nutritive value to the consumer of seeds and grains of all sorts. When grains are cooked whole, some of the cell walls are left intact, and in consequence digestion of the contents of these cells can only be accomplished if the digestive juices penetrate the cell wall. In the case of many grains, therefore, powdering or some other treatment such as pre-heating should be an aid to digestion.

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\* The same principle underlies the manufacture of ghee, namely, first sterilisation by heat to destroy the enzymes which if left result in rancidity and secondly storage in airtight containers.



231. Similarly, with many other foodstuffs chopping and mincing make digestion easier. In the case of fruits and vegetables, however, fine division of this kind should only be carried out a short time before the food is to be consumed or cooked, since disruption of the cell allows changes to set in which may destroy food values.

232. One point which should be made in regard both to methods of preservation and storage and methods of processing is the danger of poisoning. Care must, for example, be taken with cassava and some of the pulses. It is also probable though direct evidence is at present lacking, that certain green vegetables (especially Cruciferae—cabbages, etc.) may after prolonged brining contain poisonous matter which, owing to the wet nature of the food, would not necessarily be removed in subsequent cooking. It is also possible that prolonged smoking of fish, which might be advocated in the tropics to enhance keeping qualities, would produce toxic compounds, but here again direct evidence is lacking. The danger of canned foodstuffs where the can has not been absolutely air-tight is well known.

#### (d) COOKING.

233. The final stage in the handling of food is its preparation for the table, and in this cooking generally, though by no means necessarily, plays a part. Some food reformers have maintained that all processes of cooking are unnatural and are to be discouraged because of the loss of food values which follows the application of heat. To accept this view however is to lose sight of the purposes which cooking fulfils. In the first place food is sterilised by cooking and its keeping qualities enhanced. A second and more important object is the conversion of foods which are indigestible when raw into a state in which they are appetising and digestible. The appeal to appetite is particularly important. Well cooked food is more attractive to the eye, and its flavour is improved. The pleasure which it gives performs a definite physiological function in promoting secretion of the digestive juices and mobility of the alimentary tract. In other ways also cooking enables food to be more easily masticated and digested. For example, the fibres of meat, softened by suitable cooking, are more easily separated and the digestive juices are better able to penetrate the chewed food. Starch-containing foods, which are generally prepared by the grinding of seeds and grains, are more digestible when cooked, preheated, or puffed, both because the covering of the starch grain is broken and also because some at least of the starch itself may have been converted into substances more readily digestible.

234. Nevertheless the loss of nutritive factors which takes place in cooking may be important. These may be of constituents which contribute to flavour, or of mineral salts or other essential food factors such as vitamins. Of the vitamins, vitamin A and its precursor carotene are insoluble in water, and are stable at high temperatures, though they are readily destroyed at all temperatures in the presence of oxygen. The ordinary processes of cooking animal and vegetable products are accordingly unlikely to occasion significant loss of either vitamin A or carotene. Vitamin B<sub>1</sub> shows considerable resistance to heat in an acid or slightly acid medium and during the cooking of fruit, vegetables, meat, fish, and eggs destruction of vitamin B<sub>1</sub> is likely to be insignificant provided that the practice of adding soda to vegetables be rigorously excluded. Nevertheless, the fact that vitamin B<sub>1</sub> is soluble in water may lead to serious loss of the vitamin if the water in which the cooking has been done is thrown away. Vitamin C is rapidly destroyed by heat especially in the presence of alkalies.\*

235. In general it may be said that except as regards the conservation of vitamin C a long period of cooking at comparatively low temperatures is better than a shorter period at high temperatures. The essential chemical changes in cooking take place at a temperature considerably below boiling point. For example, in the cooking of protein-rich foods, such as meat, fish and eggs, the object is to coagulate the proteins. This occurs at a temperature of 140° F. Cooking therefore at any temperature above this point up to boiling point is as effective as cooking in boiling water. The same holds good in the case of meat. It may in fact be said that in stewing meat the temperature of the stew should not be allowed to rise above 180° F. Again in the case of cereals cooked with water, what is essential is to reach the "gelatinisation point" characteristic of starchy foods. This ranges from 149° F. for potato to 185° F. for oat starch. Fats on the other hand in contrast to proteins and cereals may be subjected to comparatively high temperatures (350-390° F.) without serious changes.

236. In cooking meat therefore it may be said that stewing is, if properly carried out, an ideal method. The liquid should never boil, as this hardens the proteins. The flour used for thickening should be added as late as possible as starch has a toughening effect on proteins. Where meat is stewed at the proper temperature the losses in cooking may be reduced to a minimum if the gravy is consumed.

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\* Most of the destruction of vitamin C takes place during the first few minutes of heating before the enzyme is destroyed. Boiling directly over a flame whereby a high temperature is rapidly attained is therefore less destructive of vitamin C than steaming where the rise of temperature is slow



237. Fish so readily loses its flavours in the process of cooking that it is best to employ some method by which these are conserved. Deep fat frying in which the fish is immersed in fat heated nearly to boiling point is, from this point of view, the best method. Where fish is boiled the losses in mineral salts are considerable, and may amount to as much as 40 per cent.

238. The losses of mineral salts which occur in the cooking of vegetables have been found to be surprisingly small. The principal loss which occurs is of vitamin C.\*

239. Vitamin B<sub>1</sub>, while resistant to heat in an acid or slightly acid medium is, like vitamin C, rapidly destroyed in alkaline solutions such as those produced when alkali salts are added to the water during cooking. The object in so doing is to increase the rate of cooking and to preserve the green colour and pleasing appearance of the vegetables. Local salts are used in the preparation of many vegetables, for example, by the peoples of East Africa. These are often prepared from pot-ashes such as burnt maizecobs, cow pea-pods and leaves. Although, as we have seen, this practice leads to the destruction of the vitamins, it has been found by careful inquiry amongst the peoples who use them that they are employed only for cooking certain kinds of green leafy vegetables which, if not so treated, are regarded as inedible. It is obviously undesirable in a case of this kind to attempt to interfere with local custom.

240. Although it is in general desirable that the water in which vegetables have been cooked should be consumed, there are exceptions to this rule. In some territories, for example, there are methods in existence for the cooking of certain vegetables such as beans, aroids, yams and cassava in which the cooking water is thrown away. Sometimes several changes of water are made. It has been found by experience, and confirmed in some instances by chemical investigation, that this repeated change of cooking water has the effect of removing some poisonous principle in the foodstuff. Manifestly in such a case it would be undesirable to advocate methods of cooking which conserve the original character of the food.

241. New knowledge is gradually throwing a clearer light on the various elements which enter into the flavour of foodstuffs and the reasons underlying food preferences and traditional cooking practices. As we have already suggested in an earlier chapter every attempt should be made to understand these traditions and preferences before existing practices are condemned or superseded. Existing methods should be examined and their

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\* In the preparation of stews made on a large scale, as is usual in institutional and camp cookery, and cooked slowly for a long period, care should be taken to add the vegetables at a later stage in the cooking process so as to reduce as far as possible loss of vitamin C.

value assessed with a view to suggesting the lines on which improvements may be effected. But in all such suggestions for improvement, as also for the introduction of new foodstuffs, due attention must be paid to local preferences for certain flavours and to the methods of cooking adopted to obtain them. It may well be more important to fulfil these requirements even though some loss of food value may be involved rather than to cook food in an ideal but novel manner which may be unpalatable and thus lead to its total rejection.

242. In later chapters of this report we have dwelt on the importance of educating women in questions of hygiene and domestic economy. No subject is likely to be of greater interest or value to them in improving the nutrition of their community than a study of cooking methods. In fact upon the proper training of the cook depends the well-being of the family. Where cooking is properly understood it leads naturally to an interest in and demand for a wider range of foodstuffs. The way is thus prepared for the work of agricultural departments in introducing new crops and giving instruction in their production.

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## CHAPTER X.

## THE PURCHASE OF FOODSTUFFS.

243. Bought foodstuffs may have been imported from abroad or they may have been produced within the country of consumption. As we have already said, some territories import little or no foodstuffs; others, like Hong Kong, import practically all their requirements; others again import part and produce part themselves. But even though imports may be relatively low there is often a substantial internal trade.

244. The importance of this internal trade is often overlooked, largely because it is difficult to measure. Yet it can be a big factor in a colonial economy. In Nigeria, for instance, the internal trade in forest products alone is estimated at £3 millions a year, and the trade in livestock is probably only a little lower. In most colonial territories the main articles of internal trade are foodstuffs of one sort or another.

245. The importance of this trade will in most territories inevitably increase, as a purely subsistence economy gives place to a monetary economy. From a nutritional point of view this will usually prove of advantage. While home production of foodstuffs is excellent and to be much encouraged, it must often be that the man who lives solely on crops of his own production is unlikely to have a sufficiently varied diet. As he comes to purchase more foodstuffs, he will be able to obtain more variety. He may live solely on cereals and fruits and suffer from a deficiency of high class proteins, while a little way away there is a surplus of meat for which no market can be found or a potential supply of fish. Examples of this could be found in most of the larger territories of the Colonial Empire.

246. One fundamental requirement for the development of the internal market is the provision of adequate if simple communications, which make it practicable to transport a commodity from a district where a surplus of it exists to a district in which there is a deficiency. In Uganda the recent establishment of recognised cattle routes and of a satisfactory marketing system has resulted in a reduction of the price of meat in the principal towns from 1s. per pound ten years ago to 25 to 30 shilling-cents per pound now. In Nigeria there are plenty of cattle in the North and a great shortage of meat in the South. A special cattle train leaves Kano for Lagos once a week, but

for places off the railway the trade is not yet organised. The carcasses cannot be brought all the way and consequently the cattle must be trekked long distances on the hoof, passing through areas infested with tsetse fly, with the result that there is heavy mortality and the cattle that survive arrive in poor condition. The cost of meat varies from 1d. to 1s. per lb., according to the locality and is often not obtainable at all.

247. In the Gold Coast much useful work has been done since rinderpest was brought under control, in supplying to some extent the needs of the South with meat from the North. In Nyasaland there are plenty of fish in Lake Nyasa and a considerable trade in dried fish with districts away from the Lake. Much of this trade is done by head portage and bicycles. With improved communications the radius of the trade and the quantity sold could be greatly increased.

248. Communications by themselves may not however be enough. In the Jaffna peninsula of Ceylon, which is well supplied with roads, many villages live mainly on rice and vegetables while those on the coast, never more than eight miles away, subsist on rice and fish. An exchange of fish and vegetables would be of benefit to all. It has however not followed automatically on the development of roads.

249. This example shows that there may often be need for attention by Government to the organisation of systems of marketing. This is a subject to which in recent years a good deal of attention has in fact been given and much has been done, both by central Governments and by local authorities, to improve marketing arrangements. In regard to export produce, legislation has been passed which provides for the establishment of markets at specified places. At these places grading and weighing facilities are provided and buildings may be available for hire. Often produce can only be bought and sold at these markets, sales elsewhere within the district being forbidden. The system has proved most useful in improving the quality of export produce and the return obtained by the grower for it.

250. One result of the development of local markets, whether for export crops or for foodstuffs for consumption in the towns, has been that there has been an increased demand by the producer himself for bought foodstuffs. In Tanganyika, for instance, butchers' shops have been opened at many market centres and in Uganda at the cotton markets the demand for meat and bananas often exceeds the supply.

251. In general the internal trade in foodstuffs is bound to expand. In those Dependencies which rely in the main on the efforts of small producers it is particularly important that attention should be paid to its development and that adequate numbers of district and village markets or market centres should be provided. We are satisfied that more can be done



in this direction and that with increased market facilities stimulus would be given to added local production of foodstuffs of all sorts, particularly perhaps in the West Indies.

252. It is also probable that Colonial Governments may be able to assist materially by developing the provision of storage facilities at market centres, cool chambers for the storage of fish and meat, and refrigerated vans on railways. Charges for their use would perhaps be sufficient to cover the interest charges on the capital cost of construction but even if they do not these facilities might well prove to be a useful and economical social service.

253. There can be little doubt that the development of local communications and the encouragement of market facilities at desirable centres with storage facilities at selected places will be immediately beneficial to Colonial standards of nutrition and ultimately will have far-reaching effects upon productivity and the character of the economic organization. It should be noticed that while the provision of these facilities will add greatly to the capital equipment and to the productive capacity of Colonial populations, they will not involve any very substantial capital expenditure. The quantities of materials and of labour necessary are likely to be small and the chief outlay is likely to be for personnel.

254. Where there are at present substantial imports of foodstuffs, Governments can of course encourage local production of foodstuffs by the imposition of duties on the imported article or by subsidizing the home-grown article. The extent to which it is legitimate to do either must always be difficult to determine and involves many other considerations besides those of nutrition. From the nutritional point of view, with which alone we are concerned, the cardinal consideration must always be that the greatest possible quantity of nutritive foodstuffs should always be available at the cheapest possible price, though even from the nutritional point of view this may occasionally require qualification, e.g. home-grown produce if fresh may be of more value than imported produce even though its cost may be slightly higher.

255. Most Colonial territories raise a substantial proportion of their revenue from import duties and it sometimes happens that there are substantial revenue duties on nutritive foodstuffs which could not possibly be produced locally. We recommend that all Colonial Governments should review their tariffs and take the first opportunity of removing duties on foodstuffs which cannot be produced locally, the revenue being raised if necessary from other sources. In general we feel strongly that unless there is some very good social or economic reason to the contrary or unless it is necessary to retain a duty in order to comply with obligations under agreements with the Dominions or to



assist Empire trade, imports of nutritive value should be free of duty.

256. If for social or economic reasons it is desired to assist local production for home consumption, there are, at any rate in theory, a good many arguments in favour of assistance being given by way of subsidy where this is at all practicable.\* Wisely administered subsidies are probably more effective and less of a burden on the community than protective tariffs, if the aim is to encourage production which will ultimately be self-supporting. In the first place the cost is not paid by the consumers as such, who may be the poorest classes, but by the taxpayer in the same way as the other expenses of Government, and the burden should therefore (if the incidence of taxation is fair) be borne approximately in proportion to ability to pay. Secondly, when subsidies are given, Government retains a direct interest and responsibility for what is being done, and the cost of the subsidy to the public is generally known and realized. Thirdly, when demand is elastic, it may be that a small amount added to the retail cost will cause a more than proportionate decrease in demand and conversely that a small decrease in price will cause a more than proportionate increase in demand.

257. Actually in the conditions of most Colonial dependencies it will often be quite impracticable to administer subsidies. In such cases if assistance in competing with imports is considered essential it must be given by way of a protective duty. Sometimes it may suffice if the local industry is assured against a sudden reduction in the price of imported produce. It may often be that the guarantee of a stable price would be sufficient to induce the growing of a foodstuff which is not grown at present. This guarantee could be effected without raising the local price simply by the passing of a law to provide that if at any time the c.i.f. price of the imported article fell below a specified figure, a duty should be levied sufficient to bring it up to that figure. If, for instance, the present price of imported rice were £9 per ton and it was considered that rice could be remuneratively produced in a Colony at that price, the law would provide that if at any time the c.i.f. price of imported rice fell below £9 a duty would be imposed sufficient to bring it up to that level. Arrangements of this nature have been tried in one or two Colonial Dependencies with success,† but there should be

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\* We do not wish to be taken as in any way recommending subsidies for export crops.

† There are two means of giving effect to this proposal. One is for the Director of Customs or some other authority to specify periodically what shall be the assumed value of all imports of the article in question during the next period. The other method is to make the duty vary according to the declared cost of each particular consignment. The former method is greatly preferable, but it is only practicable in regard to commodities which have a "world" market or at least a large market so that their price outside the territory is readily ascertainable.



provision for the periodical revision of the pivotal figure so as to ensure that the local price of the commodity does not become seriously out of step with the world price.

258. The number of cases in which the local producer will be assisted by a duty on the imported article is, we think, considerably smaller than is sometimes supposed. In all the Tropical African territories, with the single exception of the Gambia, imports of food are very small, and in those Dependencies outside Africa in which a larger quantity of foodstuffs is imported part of the imports does not compete with any article which is or could be produced locally. In Trinidad, for instance, of total retained imports of foodstuffs in 1936 amounting to some £1,270,000, some £340,000 consisted of imports of wheat flour, which could never be produced locally. Of the remainder part was no doubt of high priced articles which do not compete with local production, while condensed milk accounted for £116,000. The case of condensed milk is a rather special one. In the circumstances of the Colonial Empire fresh and condensed milk normally supply different markets. Except in those few territories where conditions are favourable, bought fresh milk must nearly always be a luxury article. The people who buy fresh milk are normally the wealthier members of the community; the poor man may consume it if it is produced by his own animal; otherwise he consumes condensed milk or no milk at all. We doubt whether in most territories imports of condensed milk really compete seriously with a local production of fresh milk.

259. In general, we believe that it is relatively seldom that imports of foodstuffs adversely affect Colonial agriculture although greater local production of foodstuffs is in almost every case undoubtedly to be aimed at and encouraged. This is not to deny that there are cases where imports compete with local production; rice in Ceylon is one very important such case and there are others; but their number is smaller than is sometimes supposed. We trust that whenever protective measures are proposed full consideration will be given to the effect of any change on the state of nutrition of the people.

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## CHAPTER XI.

## THE NUTRITION OF PAID LABOURERS.

260. The remarks that we make in this chapter apply just as much to earnings in the employment of Government as to earnings in private employments. In all Dependencies Governments are important employers. The conditions of employment in Government service should be a model to all private employers. The recommendations which we make in this chapter are much less likely to commend themselves to private employers if the Government which puts them forward is itself liable to the retort "Practice what you preach."

261. There is unfortunately abundant evidence that in some occupations where it is not customary to provide the employee and his family with food the wages earned are not sufficient to provide adequate nutrition for the worker and his family. Much depends, of course, on the way in which the wages earned are spent. The report received from Barbados, however, says that it is known that the weekly wage of parents (paid on Saturdays) is insufficient to feed the whole family for a week and that many children have no regular meals after Wednesday in each week and come to school hungry on Thursdays and Fridays. Somewhat similar instances could be given in Jamaica, Grenada and most of the other West Indian islands. In the case of Ceylon it is calculated that the minimum cost of a diet, made up of those foods generally eaten in Ceylon, which could be regarded as adequate but not optimal is about 15 rupee cents a day. For a normal family having a man-value of five, the cost would be 75 cents. The wages of the working classes vary between 40 cents and Rs. 1 a day—and these have, of course, to provide for other things besides food. It is clear therefore that wages at this level are insufficient to provide adequate food for a normal family unless several members of the family are working. To some extent this situation may be eased by the fact that the wage-earner in rural areas grows some of his food himself. As we have already said, this is a factor which renders any precise calculation very difficult. But we do not think the general proposition would be disputed in regard to many colonial territories. Nor can the fact that the employee supplements his wages from other sources be regarded as in any way justifying a low level of wages, though it may mitigate the effects of it.



262. The obvious reaction to such a situation is to say that the rate of wages should be increased. Apart altogether from considerations of humanity and social justice, it may well be that increased wages may be justifiable as a purely economic proposition. They might well lead to a more than proportionate increase in efficiency. Much labour in tropical countries is notoriously inefficient at present and there is striking evidence of the extent to which this is due to malnutrition. At the same time it may be that in some cases an increase in wage rates would not lead to an increase in total earnings, because there would be less employment and the wages earned might therefore be more intermittent. In many of the sugar-producing colonies, for instance, sugar is almost the only possible export crop. The price of it is low and the quantity that can be produced is limited by international agreement. It may well be that if employers were forced to pay higher wages less labour would be employed and the total wealth of the labouring community would not in the result be increased. Moreover an increase in wages does not necessarily mean improved nutrition for the worker's family. While it is true that any increase in the standard of living is to be welcomed, it cannot be expected that the whole of an increase in wages will be spent on food. Wages may be spent in plenty of other ways.

263. Generalization regarding rates of wages is difficult and rash, and it imports many other considerations besides those of nutrition. We have not regarded it as our business to investigate all these considerations in full, though we are glad to learn that much attention is being given to them at present and that a Labour Adviser has recently been appointed by the Secretary of State for the Colonies. We must content ourselves with stating the fact that, at present, wage rates are often insufficient to provide a man and his dependants with adequate nutrition; we must leave it to others to determine how far in those Dependencies where this state of affairs exists the end which everyone must desire can be attained by an increase in wage rates.

264. Though we have felt bound to make no recommendation on the subject of wage rates, we feel that we need have less hesitation in regard to various measures whereby Governments and private employers can contribute to the better nutrition of their labourers. We think that there are opportunities for immediate action which will be of benefit to all concerned, employers, employed and the community as a whole. It has long been realised that poor feeding is one of the chief causes of high mortality and morbidity and low efficiency in labour in the tropics. Proper feeding, proper housing, proper hygiene and proper attention to the habits and customs of the labourer: these are as important as questions relating to hours of work and



rates of pay in securing a contented and efficient labour force, and of these proper feeding is certainly not the least important.

265. It is perhaps not unnatural that the question has received most attention in those parts of the world where it is the habit for the labour contract to provide for food to be given in addition to wages. In paragraphs 266 to 281 of this chapter we deal with the question in relation to those territories. In the remaining paragraphs we discuss its application in other parts of the Colonial Empire where too often the food obtained by his employee has in the past been regarded as of no concern to the employer.

266. The first valuable evidence on the subject came from South Africa, where the incidence of pulmonary tuberculosis among the employees on the Rand had long been remarked as tragically high. A specially appointed committee suggested that the predisposing cause was probably dietetic in origin, and in 1911 Government scales for the feeding of native employees were drawn up. Since then the importance of the diet of the labourer has become much more generally realised both by Governments and by private employers, at any rate in those territories where it has been customary for the labour contract to stipulate that the employer should provide food in addition to wages. This is normally the case in East and Central Africa, in the Katanga and on the Rand, where many East Africans are employed.

267. The whole question of the treatment of native labour has been most carefully studied in the Belgian Congo, on the Rand, and by the big mining companies in Northern Rhodesia, and a great body of information has been built up as to the best form of diet to give to the labourer, having regard to his traditional food habits. Hand in hand with attention to the dietetic needs of labourers there has been a great improvement in their housing, in the prevention of disease and generally in the care for their welfare. While it is difficult accurately to distinguish the part played by improvements in feeding as distinct from improvements in other directions, the net result of them all has been an immense decrease of mortality and an immense increase of efficiency. Thus in the seven years between 1926 and 1932 the mortality on the Union Minière properties in the Katanga fell progressively from 53 per thousand to 8 per thousand.

268. Much work has also been done in South Africa by Orenstein, Fox and others. On the Rand at present the Central Mining-Rand Group, employing 300,000 labourers a year, include in the ration mealie meal bread having not less than 64 per cent. of wheat flour, beans, meat, nuts and fresh vegetables to a calorie value of 4,400 on the minimum scale. This diet which is considered to have proved adequate in all respects,



with the possible exception of vitamin A, costs, cooked, per worker per day, approximately 4d. Provision is made for the cooking in central kitchens of such dishes as meat stew, to which slightly cooked vegetables are added after they have been finely minced by special machines. This ensures that the worker profits by the minerals and vitamins in the vegetables. Records have been kept of over 20,000 discharged workers of whom over 66 per cent. gained substantially in weight during their term of residence in the mines of six months or more, the average gain in weight being nearly 7 lb.

269. In Northern Rhodesia an elaborate minimum scale of food is now laid down by Government for labour working on the mines. Several of the big mining companies give food substantially in advance even of this scale. The Rhokana Corporation, for instance, have recently decided to alter the diet given to their workers in the direction of reducing the total number of calories and increasing the supply of meat and fat. The existing and new scales are attached as Appendix 4. On the basis of 6,000 employees this improvement will cost the Corporation £7,500 a year. The manager of the mine writes: "If an increased efficiency of as little as 5 per cent. could be guaranteed by the balanced dietary advocated it would be a sound economic proposition". It is too early yet to state the result of the experiment.

270. In East Africa too a good deal has been done. Improper feeding was undoubtedly largely responsible for the terrible mortality among the East African Carrier Corps during the earlier part of the War and for the heavy mortality in some of the earlier railway construction. Since then there has been a great improvement. Post-war labour rations may be illustrated by reference first to the Lake Magadi Soda Company in Kenya, which in 1927-28 supplied to a yearly average of 750 employees a ration of 2 lb. maize meal daily, 2 lb. meat and bone weekly in two portions, 2 lb. beans and peas, weekly in two portions and salt *ad libitum*. This diet was admittedly deficient as regards fresh vegetables and meat, but in spite of this, the medical examiners reported a striking improvement in health and physique, an increase in weight of 8-9 lb. per man over a period of six months and entire absence of scurvy and other food deficiency diseases. The higher-paid workers who supplemented the rations with supplies purchased from the local shop and with herbs and green leaves bought from itinerant vendors, showed a lower sickness rate than the more poorly paid labourers. Taking medical cases only into account, the number admitted to hospital in 1928-9 was, for the better class labourer, 13 per cent.: for the others, 40 per cent. These figures show that the diet provided for the majority was still capable of improvement.

271. On the Kisumu-Yala Railway Construction (1929) again, the diet of the labourer received particular attention, maize meal, pulses, fresh meat, ground nuts or ghee, fresh vegetables and salt being provided to a monthly average of 2,200 labourers. The average number of working days lost was .25 per head per month and the monthly hospital admissions were 0.5 per cent. The very lower ulcer rate of 20 per month strongly suggests (as the medical officer writes) "that a properly balanced ration combined with proper attention to minor injuries will go far to eradicating ulcers as a cause of loss in a labour force". In this scheme only seven men are recorded as having died, equivalent to one death per  $3\frac{1}{2}$  miles of line, whereas in pre-war constructional works of the same kind in this territory the death rate was many times this figure. Improvements in general hygiene contributed to this change, but undoubtedly improvements in diet were one of the most important factors.

272. Other striking instances in which private employers have found the benefit of giving adequate rations have occurred more recently. In Kenya, according to the Annual Report on Native Affairs for 1935, three gold mining companies "issued liberal cooked meals to their labourers three times a day, consisting of maize flour with sugar, beans, green grams, meat, fresh vegetables, fruit and salt".\* The Report states that the satisfactory scale of rations undoubtedly contributed very largely to the excellent health which the labourers enjoyed during the year and also to their state of general contentment.

273. Another striking experiment was introduced within the last two years in Zanzibar. In August, 1937, the Clove Growers' Association decided as an experiment to provide well-balanced meals for an average of ninety labourers a day at a cost of 49 cents of a shilling (about 6d.). Unfortunately the experiment had to be interrupted before it had been going very long and has only recently been resumed. The indications were, however, that provided the employee remained in regular employment for some weeks, his capacity for work was greatly

\* The morning and mid-day meals consisted of maize flour, gruel; the evening meal of maize flour porridge with the following supplements:—

|           |  |
|-----------|--|
| Monday    | Meat, 1 lb., cooked together with vegetables (curly kale, carrots, onions and chillies). |
| Tuesday   | Vegetables cooked in ghee (curly kale with tops of leeks).                               |
| Wednesday | Meat, 1 lb., with vegetables (tomatoes, green beans, onions)                             |
| Thursday  | Beans or mixed vegetables cooked in ghee, and lemons.                                    |
| Friday    | Meat, 1 lb., with vegetables (curly kale, mint, beetroot, leeks).                        |
| Saturday  | Beans or mixed vegetables cooked in ghee, bananas if available.                          |
| Sunday    | Soup of green grams and ghee.  |

In addition hot cocoa was given to all labourers coming off shift, except those working on the surface during the day shift.



increased by regular nourishing food in sufficient quantity, and that increased efficiency more than compensated for an addition of a little over 50 per cent. in the average individual cost of a labourer.

274. In Tanganyika one large employer of labour used to reckon that of his total labour force only from 45 to 50 per cent. could be relied upon to turn out for work on any one day. More recently, it is reported, the figure has increased to over 90 per cent., the increase, it is said, being due solely to an improvement in the diet given.

275. In Uganda, as an example to private employers of labour, Government has recently provided a well-balanced diet for the labourers employed on road construction. This has resulted in a very much lower incidence of sickness than is usual in such constructional work.

276. Naturally most has been done by large companies which can face the immediate increase of expenditure that is usually involved in improved feeding of labour. It is partly because there are so many large-scale enterprises in the Belgian Congo that so much progress has been made there on this question. Some of them, besides providing more adequate rations for their employees have incurred great expense on providing for their housing and for the prevention of disease, on the acclimatisation of labourers coming from a distance, on organizing agricultural production so that the desirable foodstuffs may be available, and so forth. We believe that on a long view such expenditure is remunerative. It is difficult for the smaller concern or the farmer, often struggling with many difficulties, to take a long view. We believe, however, that whatever may be the case with other measures of social welfare, the benefits of improved feeding should very quickly disclose themselves in increased efficiency. We regard it as almost certain that in Africa, quite apart from humanitarian considerations, any money spent on bringing the food consumed by the labourer up to an adequate well-balanced ration will be money well spent from the immediate point of view of an employer.

277. Nevertheless, the tradition that a labourer can do all that is required of him on rations of cereals and little or nothing else is slow in dying. It is still not uncommon in East Africa and it is widely prevalent in West Africa and in other parts of the Colonial Empire where, because it is not the habit of the employer to provide food for his employees, less attention has been given to the subject. It cannot be sufficiently emphasised that while a diet of little or nothing but cereals may keep body and soul together, it cannot suffice for full efficiency.

278. We feel sure that there is considerable room for further action both by Governments and by employers to improve the feeding of their labourers. Still confining ourselves for the moment to the case of the labourer who is fed by his employer, we consider that Governments should themselves lead the way by providing a well-balanced diet for all their labourers. We also consider that legislation should be tightened up. A law which provides merely that adequate rations must be given is not sufficient unless backed up by detailed measures to ensure that the term is properly interpreted by the employer. At present it is often interpreted as meaning no more than so many pounds of maize meal or other cereal with a little salt and possibly a few vegetables and meat if available. We recommend that the Governments of all African territories—and of any other territory where the labourer is fed by the employer—should provide as soon as possible that where the labour contract provides for rations to be given to labourers, either by Government or by any other employer of labour, they should not be below a scale approved by the Health Department as being sufficient to provide a well-balanced diet, having regard to modern nutritional knowledge and the normal diet of the employee.

279. The legislation should specify as exactly as possible the diets to be given. Naturally there must be a certain amount of latitude to permit of the foods given varying according to what foods are available in a particular district at a reasonable price. There must also be latitude to permit of the ration given being related to the normal diet of the employee, which may vary greatly according to the particular race or tribe from which he comes.\* The exact food to be given by any particular employer should therefore be a matter in the first instance for the employer himself but he should be required to work out a schedule of diet in consultation with the local health authorities and for their approval, and this schedule should be in accordance with provisions as precise as possible in the legislation of the territory.

\* On the Rand mines, however, men from all tribes are given the same diet, except that those who are normally fish eaters are given fish instead of meat. The ration given is equivalent on the average to the following number of ounces daily :

|                     |     |      |                     |     |      |
|---------------------|-----|------|---------------------|-----|------|
| Mealie meal...      | ... | 24   | Soup meat (or fish) | 1.7 |      |
| Bread               | ... | 6    | Ground nuts         | ... | 2    |
| Beans or peas       | ... | 1.5  | Sugar               | ... | 1    |
| Germinated beans or |     |      | Vegetables          | ... | 5    |
| peas                | ... | 1.5  | Salt                | ... | 0.5  |
| Meat (or fish)      | ... | 6.85 | Cocoa               | ... | 0.25 |

About 16 ozs. of Kaffir beer (made of millet) are given twice weekly. The raw ingredients of this diet cost about 4d. per man per day, the low cost being made possible by the large quantities purchased. Overhead charges incurred in cooking probably double this cost. The meat (other than soup meat) is given to the men about three times a week for them to cook themselves. The rest of the food is provided ready cooked.



280. Where there are such wide variations in diet as there are in Africa, we suggest that Colonial Governments would do well to arrange for the issue of a handbook for the use of employers setting out the main constituents of the normal diet of each tribe from whom labour is recruited.\*

281. The food provided by the employer is sometimes given cooked and is sometimes handed over to the employees for them to cook themselves. Arguments are advanced in favour of both practices. It is said that when the food is cooked by the employees themselves it will be cooked in accordance with their usual habits, while if it is cooked for them it will always be difficult to be sure of doing this. It is also certainly less trouble for the employer to leave his labourers to cook their own food. The arguments on the other side are, however, strong. Men without the help of their womenfolk are seldom likely to make the best use of the rations given out to them for them to cook themselves. The food given may be such that they cannot cook it properly without considerable trouble. Cases have been known, for instance, where the rations consisted solely of maize and beans and the beans required eight hours cooking to make them properly digestible. Not unnaturally they would seldom be properly cooked. If the food is provided ready cooked it is possible to see that it is properly prepared and not overcooked or undercooked. It is also possible to include unpopular items of nutritional value, such as germinated beans, and to ensure that the food is really eaten by the employee and not sold by him, in which case, of course, the employer derives no benefit. For these reasons we believe that the clear balance of advantage lies with the giving of food ready cooked. Those employers who have provided communal kitchens for feeding their labourers have found that it has paid them. It should, of course, go without saying that where food is provided uncooked or where labourers are expected to provide their own food adequate facilities should be given for the food to be cooked.

282. In the previous paragraphs we have been concerned with the position in those parts of the Colonial Empire, chiefly in East Africa, where it is customary for the employer to feed his labourers. Elsewhere the labourer is expected to find his own food. Sometimes where this is the practice, the employer has paid a certain amount of attention to the diet of his labourers, as on certain estates in Malaya, Ceylon, Mauritius and elsewhere, but it is perhaps natural that in general the question has aroused less interest than in areas where the labourer is fed by his employer. We consider that although

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\* One such handbook has been prepared already by the Government of Tanganyika—see “The Tribes of Tanganyika, their Districts, Usual Dietary and Pursuits” by R. C. Jerrard, Dar-es-salaam, Government Printer, 1936, 1s.

the employer in these territories has no direct responsibility for the food of his labourers there is still a great deal that he can and should do in his own interests to see that they do in fact obtain food which is adequate to maintain them in full health and efficiency. The main conclusion, we believe, still holds good: it will pay the employer to see that his labourers are properly fed.

283. The inefficiency and irregularity of tropical labour has in the past been taken too much for granted; it has been regarded as irremediable. We believe this to be untrue. It is common ground among all those who have experience in the matter that the less the labourer is regarded as merely a person who works for so many hours a day and receives a wage for it and the more the employer makes it his business to care for the social welfare of his employee, the more satisfactory are the results. Too often at present the employer is apt to regard his responsibilities as finished when he has paid his wage bill. We feel it to be important that in the areas where the development of paid labour is proceeding fast, as for instance in West Africa, Governments should see that employers in their own interests do not neglect to provide for the welfare of their employees. Similarly in some of the Colonies where paid labour has long been in existence, as in the West Indies, there still sometimes persists what may not unfairly be termed an eighteenth century attitude in the relationship of employer to employee. Governments by their own example as employers of labour and by their legislation should lead the way to improved conditions of employment. Where there is a shortage of labour, there will be some incentive to employers to improve conditions without action by Governments. But where (as in many territories) there is an ample supply, it is the more important that Governments should by example and legislation provide the necessary stimulus. Adequate nutrition will not by itself make the labourer a model employee, for, as we have seen, there are many other aspects as well; but nutrition might well make him a great deal more efficient and happy than he is at present. As the report from Trinidad suggests, a 20 per cent. increase in the efficiency of the labourer might well make all the difference between a profit or a loss on the year's working, and we do not regard such an increase as by any means impossible as the result of improved nutrition. We are happy to think that public opinion is increasingly realising the importance of the proper feeding of labourers and the frequent inadequacy of the diets that they are at present able to obtain.

284. We do not wish to be taken as necessarily suggesting that there should be a change-over to the system prevailing in East Africa of the employer being entirely responsible for



feeding his labour. There are many reasons why this system does not prevail now. The labourer may bring his wife and family with him and the employer could seldom be expected to feed them all—though in the Katanga food is provided for the women and children of labourers as well as for the labourers themselves. It may not be customary for the labourer to work six days a week for his employer. In the West Indies, for instance, he often prefers to work two days a week for one employer, two days for another, and to do nothing, or to work on his own holding if he has one, for the remaining three days. The West Indian labourer is of an independent nature and often does not like to be tied to any particular plantation. Similarly in West Africa much of the labour is very transitory. Again sometimes the labourer might resent as lessening his independence an attempt on the part of the employer to provide him with all his food.

285. Indeed while the feeding of labour by the employer may in some areas be necessary and valuable as an interim policy designed to promote an immediate improvement in physical well-being and as a convenient practical means of introducing a better diet, on wider grounds its perpetuation may prove undesirable. We do not for one moment intend to recommend a condition of perpetual dependance by the employee on the employer as in itself desirable. Obviously a preferable alternative would be the education and advancement of the labourer and his family so that when he freely exercises his own choice his choice of a diet is a good one, and he has the money to buy it.

286. For all these reasons it is perhaps unlikely that the custom of employers providing labourers with all their food will spread much beyond the areas where it exists at present. At the same time where conditions appear favourable, as perhaps in parts of West Africa, we hope that the possibility will at least be considered.

287. There are, however, many other ways in which employers can assist. One way is by enabling as large a proportion of their labourers as possible to have their own gardens, whenever the labourers and their families are more or less permanently resident on the land of the employer. We have already made this point in a previous chapter (Chapter VII, paragraph 121). We recommend that every possible effort should be made by employers in their own interests to provide for each labourer a plot of land, however small, where he and his family can grow vegetables and other foodstuffs for their own consumption and can also keep poultry and some livestock.

288. Another way in which they can assist is by distributing *some* food to their employees in addition to their wages, even though they do not undertake to feed them entirely. This

already occurs in various parts of the Colonial Empire. In Sierra Leone, for instance, rice is given in addition to the wages. In the West Indies the labourer sometimes has by custom certain perquisites. We are strongly of opinion that employers would often find that it paid them to extend this practice and to give meat and fresh vegetables and other specially nutritive food to make up the known deficiencies in the local diets. It is most important that any such food should be given *in addition* to and not in lieu of wages. (We return to this point in paragraph 293 below).

289. If for one reason or another it is not possible to give specially nutritive foodstuffs free, it may be possible to make them available at a cheap rate. Thus, in Ceylon, estates in European ownership usually arrange for supplies of rice to be available at reduced rates. The practice might well be extended to other foodstuffs with benefit to all parties. In the Gold Coast certain of the mining companies have recently erected refrigerators and arranged for the importation of special supplies of meat which they make available at cheap rates. It is reported that the experiment is proving successful. This, too, is an example that might well be copied elsewhere.

290. In some cases employers might well pay more attention than is done at present to the production of foodstuffs for their employees on their own lands or on neighbouring lands. Indeed, the recent report of a locally appointed Commission on the disturbances which took place in Barbados in 1937 recommends that all owners of estates should be required by law to plant with vegetables every year at least 5 per cent. of their arable acreage, under the direction of the Department of Agriculture. With the limitation of the total quantity of sugar that can be produced, estates in many of the West Indies may well have land which they cannot use for sugar cane and which is not obviously suitable for any other export crop. They may well find that a very advantageous way of using such land is to grow foodstuffs for free distribution or for occasional free meals to their employees.

291. Sometimes it may well be that it would pay big employers such as mining companies to keep their own agricultural staff to promote the growing of nutritive foodstuffs in the vicinity of their enterprises. Much has been done in this way in the Belgian Congo, where mining companies have gone so far as to create agricultural colonies and to create a stock-rearing industry by the introduction of thousands of head of cattle in order to build up a food supply for their labour.

292. Governments might often assist employers by ensuring freedom from import duty and cheap freight rates on railways for food of nutritive value which cannot be produced locally



in adequate quantities. It may be, for instance, that in West Africa the freight rates on meat products are at present so high as to make it difficult for the employers to make meat available for their employees at a reasonable cost.

293. There are dangers in several of the above recommendations and some care on the part of Government may be necessary to ensure that the evils of the truck system do not creep in. The essence of the truck system is that the labourer is paid part of his wages in the form of credits at a store run by his employer or that he is otherwise compelled to buy the necessities of life from his employer. There is legislation in most Dependencies to prevent this and we do not think that our recommendations are likely to open the door to serious abuses. In some of the colonial truck laws provision already occurs on the following lines:—

“ Nothing in this Ordinance shall render illegal an agreement or contract for giving to him food, a dwelling place or other allowances or privileges in addition to money wages as a remuneration for his services.”

Our recommendations do not go beyond this. The essential points are (1) that any food or perquisites given shall be *additional* to wages and not in lieu of wages and (2) that there shall be no compulsion on the employee to spend his money in any particular manner that may be desired by the employer.

294. Employers may often do most valuable work both for themselves and the community at small cost by organising maternity and infant welfare work and other such work among the families of their employees. Much, we know, is already being done in Malaya and Ceylon in this way. Some employers in these Colonies provide free meals for children on their estates and maternity, infant welfare and other social services. Expenditure for such purposes may not at once prove remunerative, but the work is of considerable social significance, and makes for a contented and permanently established labour supply of better physique. By such measures employers may make a real contribution to the well-being of the community.

295. We believe that the whole subject discussed in this section is one on which considerable immediate improvements could be effected to the benefit of employer and employed and of the community as a whole. We have emphasised our opinion that increased attention to the feeding of labourers would be remunerative, not because this aspect is more important than the human consideration that it would bring increased health and well-being, but because it is perhaps less obvious and because the financial factor is naturally an important consideration. We believe that this is a case where the interests of finance and humanity coincide. There is also another aspect. In several parts of the Colonial Empire one of the main limiting factors

to development is the shortage of labour. It is essential, therefore, from the point of view of the community as a whole that the most should be made of the labour that is available. In those territories where at the same time there is an actual or potential shortage of labour and the labour is inefficient and has a low output, any measure to increase the work done per man is an obvious economy. Another advantage from the point of view of the community of accustoming labourers to a nutritionally adequate diet is that it should have considerable educational value. The men who have benefited from a good diet while in paid employment will be less ready to acquiesce in an inadequate diet in their own homes. For all these reasons we hope that real progress will be made in improving colonial nutrition generally by increased attention by governments and employers to the feeding of labourers.

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## CHAPTER XII.

THE FACTOR OF IGNORANCE AND THE NEED FOR  
EDUCATION AND PROPAGANDA.

## (a) INTRODUCTORY.

296. In previous sections we have considered the various directions in which a low standard of living leads to malnutrition. We now turn to what we have called the second main cause of malnutrition, ignorance coupled with prejudice.

297. The ignorance (and sometimes the prejudice) is not confined to those who are themselves undernourished. It exists also among those who have power over nutrition of others, Government officials, members of Legislative Councils, employers of labour, education authorities, missionaries. That this should be so is not to be wondered at, for the study of nutrition is a new science and it is only quite recently that some of its broadest conclusions have obtained general acceptance. It is therefore no reflection upon those responsible for agricultural development if their policy has not always recognised the importance of promoting adequate nutrition, nor upon medical authorities if they have failed sometimes to appreciate that one of the best means of preventing some of the most prevalent diseases is to improve the state of nutrition of the population. Nor again is it to be wondered at that education authorities, whether missionary or Government, have often spent time and money in trying to instil knowledge into the heads of children who, it is now realised, may be too ill-nourished to be able properly to absorb it; nor that employers of labour should often have been content to employ labourers who, owing to their state of nutrition, cannot do a full week's work and are frequently off duty. For the bearing of nutrition on health, efficiency and happiness has only recently begun to be fully appreciated.

298. The first requisite is that there should be a wider general appreciation of the importance of nutrition. We have emphasized that malnutrition is largely the result of a low standard of living, but there is no doubt that a properly directed policy could do much to remove malnutrition even at the present economic level. We do not wish to imply that nothing has been done already. The "Summary of Information" contained in Part II of our report shows that in almost every part

of the Colonial Empire some part of the problem is being tackled. Meals are being given to school-children, infant welfare centres and health visiting are increasing, more attention is being given to the growth of food crops, the diets in Government institutions have been improved, investigations are being made into the extent to which nutritional diseases exist, and an agricultural or health bias is being given to education. A beginning has been made: but only a beginning.

299. One of the difficulties in securing a proper regard to nutrition in the direction of policy is that, while the subject is rather a technical one, it is also vast, varying as it does from infant welfare to agricultural or veterinary science or to complicated considerations of economics. It thus affects many departments of Government, few of whose officers have the opportunity to appreciate its whole range. The departmental proposals must be co-ordinated by officers who themselves have little technical knowledge. It is necessary therefore that many Government officers should have some knowledge of the principles of correct nutrition and the practical means of securing their application. Accordingly we recommend that some instruction on human nutrition, particularly the practical application of scientific knowledge in colonial conditions, should be given not only to Medical and Health Officers but also to Administrative Cadets during their courses at Oxford and Cambridge; to Agricultural and Veterinary Officers during their courses at Cambridge and the Imperial College of Tropical Agriculture, Trinidad; and to all Education Officers and Teachers in both Government and Mission schools who attend courses at the Institute of Education or elsewhere. We know that the courses, particularly those taken by the Administrative Cadets, have already a very full syllabus, but we feel that the importance of this subject certainly warrants its addition to the syllabus.

300. Medical and Health Officers already normally receive some instruction in the subject but it is not normally related to the circumstances of colonial territories. As we have already pointed out, it is little use considering colonial nutrition in terms of European foodstuffs. Knowledge of colonial nutrition is still scanty but we hope that in future every attempt will be made to make the teaching of nutrition given to colonial officials immediately applicable to colonial conditions. This report will sufficiently indicate the lines that instruction should take. Possibly it may itself be useful for purposes of instruction.

301. Colonial Governments should also consider ways and means of giving instruction on the subject to staff recruited locally for the Administrative, Health, Agricultural, Veterinary



and Education services. All officials who in their work will be in any way in a position to influence the nutrition of the mass of the people should know at least how the most common deficiencies in their diets can best be remedied. Moreover, those who are nearest to the people will have the most power by the example of their own lives and those of their families to demonstrate the advantage of, say, more scientific feeding of children. We return to this point later.

302. There will be no difficulty in rousing the interest of those who occupy positions of responsibility in the administration and development of the Colonial Empire. It is when we come to consider the ignorance and apathy of those who are themselves undernourished that greater difficulties occur. The first difficulty is innate conservatism, often backed up by prejudices, religious scruples or taboos. For instance, eggs are not eaten by certain peoples, though eggs are obtainable and the diet is lacking in protein, minerals and vitamins. In Grenada there is a superstition that milk is the cause of worms in children; in some parts of Ceylon it is believed to cause illness, and milk or milk products never occur in the diets of large classes of the population. In the New Hebrides milk is regarded as a dirty food. In Africa taboos are found in parts of Tanganyika which prevent women from eating eggs or drinking milk, and in Buganda they prevent them from eating chicken or mutton. In other parts of Uganda adult males may not drink milk.

303. The opinion has been held in the past that people always know what is best for them. While that easy-going view is admittedly no longer tenable, we should none the less hesitate to condemn their prejudices, for they often have foundation in fact. For example, as the Ceylon report points out, the fear of the dangers of milk is probably well founded, in view of the highly insanitary conditions under which milk is at present produced. However, some of these prejudices are clearly wrong and provide a barrier to progress, which will be difficult to surmount until general education has advanced much further than it has at present in most parts of the Colonial Empire.

304. In considering how to set about removing ignorance on the subject of nutrition, we wish to place the greatest possible emphasis on the importance of the part played by women. In many parts of the Colonial Empire it is hardly too much to say that they alone affect the nutrition of the people. In some parts of Africa according to tribal custom it is the women who decide what food crops to grow, who actually grow them, who reap them, store them, cook them and serve them. Even if they do not themselves grow the food crops, they have the cooking of them and the selection of the menu for each day, and if the family buys its foodstuffs, it is the women who do the marketing. How important skill in marketing may be in securing

adequate nutrition has been shown many times in advanced countries. For instance, in an inquiry in the United States of 900 families with identical expenditure on food approximately one-third secured an adequate diet while the other two-thirds did not. The only varying factor was the competence of the housewife. We can hardly doubt that it is an equally important factor in the Colonial Empire. Further, the women are naturally responsible for the feeding of infants and young children, and their own diet during pregnancy and lactation can have a great influence on the health of their children. Finally it is the women who are the home-makers and who set the standard of life for the whole family. It is difficult therefore to exaggerate the importance of the women's part. We hope that with an increasing realization of the value of improved nutrition, increased attention will be given to the education of women. There has recently been a considerable move in this direction, but undoubtedly too little attention has been given to it in the past.

305. A corollary of this is the greater use of local women as Government welfare agents—as schoolmistresses, health workers, midwives, etc.—and in some cases the increased employment of European women to supervise and organise the work.

306. We may divide the attack upon ignorance into two sections: first the attack upon ignorance among adults, which is sometimes known as community education or welfare propaganda, and secondly the education of the younger generation in the schools. It will also be convenient to deal separately in the next chapter with one aspect of the matter of great importance, namely infant welfare work.

#### (b) WELFARE PROPAGANDA.

307. The people who must be reached will be largely illiterate. The art of welfare propaganda among such people is still undeveloped; the one thing that is certain is that it requires a different technique from that applicable in a country where the majority are literate. The efficacy of the printed word is restricted and the sphere of the personal agent enlarged. But the technique will necessarily vary according to the traditions and civilization of each people. Amongst other things it will have to take into account in many territories the communal nature of society, which often implies that for a change to be effectively introduced it must be accepted not by a few individuals but by the community as a whole. Indeed even apart from this factor many of the changes are of such a nature that in any case they would be ineffective unless introduced by all the community, for instance, some kinds of anti-malaria work.



308. The working out of the technique of welfare propaganda in the Colonial Empire will require understanding, imagination, and ingenuity. The whole subject is one which would well repay further study, and we commend it both to the Secretary of State and to Colonial Governments as a fruitful field for inquiry. We regard it as so important, however, and as having so direct a bearing on the remedying of nutritional deficiencies that at the risk of somewhat extending the scope of our inquiry we have ventured to include in the following paragraphs a discussion of the subject as a whole, not confining ourselves strictly to the application of propaganda to nutrition matters. A very great deal of welfare propaganda is being done in the Colonial Empire but so far as we know no attempt has yet been made to collate and consider as a whole the experience gained. Many of the measures we discuss will of course be equally valuable for other forms of social and economic progress besides nutrition. Nutrition, as we have said before, is not a self-contained subject.

309. We consider first the various means of propaganda—the printed word, broadcasting, cinemas, gramophones, etc., secondly the agents or personnel of propaganda, and thirdly the principles which seem to us to be suggested by our consideration of the subject.

#### (i) THE MEANS OF PROPAGANDA.

310. *Circulars*.—The greater the degree of illiteracy, the greater the prestige of the written word. Circulars in this country are generally thrown away unread. In Tropical Africa every word is read with the utmost attention by those who can read and they will in their turn read it aloud to a circle of listeners. Thus in a sense the very fact of illiteracy may help to “get across” any idea that it is desired to disseminate.

311. The following example illustrates this apparent contradiction. In a certain district of Tanganyika a campaign was started to persuade mothers not to give solid food to their infants. As the culmination of the campaign, when the subject was already much under discussion everywhere, several hundred copies of a suitable letter were cyclostyled and sent out addressed personally to women prominent in village life. “The psychological effect,” write the originators of the idea, “was colossal. . . . Not one of the women could read, and it requires little imagination to picture the stir and excitement in the villages when they received a letter from the Boma. It was the first letter they had ever received, it was, as they soon discovered on rushing to the nearest literate man, an official document personally directed to them by the district officer himself, and it was obviously of immense importance. The news, of course, became public at once, and the letter had to be read out again

and again, or its contents recounted over and over, to friends as they crowded round to hear what the excitement was all about. The prestige of the recipients went up by leaps and bounds, and as a result of all this they began to take the contents of the letter very seriously, as befitted a matter so weighty that the Bwana Shauri had had to write to them personally about it.”\*

312. In this example the women’s inability to read was turned to account, in that any letter they received became a public occasion. The ground had already been prepared by other means of propaganda, and the letter was the culminating and decisive factor in the campaign. Obviously the same process could not be repeated very often.

313. *Reading circles*.—There are, however, other ways of reaching the illiterate by means of the printed word. Another project which has been tried in the same district of Tanganyika and also, we believe, elsewhere is the formation of reading circles, that is to say gatherings at which one literate person reads aloud to a circle of illiterate listeners. Reading circles may be found to form naturally with a little encouragement from the administrative authorities. They could be quite informal and it should not be difficult to find a literate man who would be ready to act as leader to a circle, for the position gives prestige and prominence. In describing experiments in Tanganyika, the writers say that “the system makes use of what already exists—a sprinkling of literates, the African’s inherent histrionic ability and the age-old custom of gathering together to listen to a story”, and it has the great merit of involving little or no expense.

314. *Leaflets*.—But not all the people of the Colonial Empire are entirely illiterate, nor is it only the illiterate that must be reached. The printed word may therefore be of direct propaganda value. For example specimen diets might be prepared in different parts of the Colonial Empire. These might well be embodied in leaflets in the local vernacular, setting out in very simple and non-technical language the principles of correct nutrition. Other leaflets may be prepared on the proper feeding of infants and infant welfare generally. Such leaflets should be widely distributed by every available means. They may sometimes be used most profitably in association with the cinema van, the magic lantern and broadcasting. Many Colonial Dependencies have already prepared literature of this kind, and a great deal of use has been made of propaganda leaflets in the Netherlands East Indies.

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\* See “Social Propaganda in Illiterate Africa” by A. T. and G. M. Culwick in “Oversea Education,” April, 1938.



315. *The Press*.—The local Press too is obviously a powerful influence and we suggest that Colonial Governments should take steps to interest its representatives in the subject of nutrition and welfare propaganda generally. It may often be possible to secure regular weekly articles on some aspect of nutrition or on other social welfare problems, and the time spent by Government officers in preparing them would not be wasted. We hope that this Report will itself provide material or at any rate ideas for a number of such articles. Governments should also keep the Press informed of any new developments in social welfare work, both by the issue of bulletins to the Press and by inviting its representatives to “write up” the subject. It should be the special duty of the Nutrition Officer whose appointment is recommended in each territory to see that these possibilities are not overlooked. In many Dependencies the Agricultural and Health Departments publish regular bulletins to keep the public informed on agricultural and health topics. This we regard as a most valuable practice and we commend the example to all Colonial Governments. Education Departments in some of the larger territories issue journals for teachers and others. This too seems to us a valuable practice. The circulation of the Nigerian journal now exceeds 9,000 copies a month.

316. *Lending Libraries*.—An idea which may be worth considering is the forming under Government auspices of lending libraries of vernacular literature. Obviously one limiting factor in the circulation of vernacular literature is inability to afford the cost of buying it. Such libraries might be found to be very useful in connection with the readers’ circles suggested above. They have been largely developed in the Netherlands East Indies where there are now over 3,000 such libraries controlled by the Bureau of Popular Literature.

317. *Cookery books*.—Various Colonial Governments have suggested that cookery books applicable to local conditions would be of value. Some already exist, though many of them have been written mainly for the use of European residents. What are required are simple cookery books dealing with indigenous foodstuffs, prepared in a form suitable for use in domestic science training at schools. We understand that one or two such books are now being prepared.

318. *Adult classes*.—Direct instruction in regular “adult classes,” conducted by schoolmasters, health visitors or the like may in some territories be a useful form of propaganda, especially if coupled with the use of the wireless, the cinema, the magic lantern or the gramophone (all of which we consider below). Particularly it may be valuable in teaching women domestic science in all its forms. But coupled with theoretical

instruction there should always if possible be practical demonstration. Teaching about the care of children might for instance be linked up with the work of an infant welfare centre. Plenty of opportunities of course occur for Administrative and Health Officers and others to give informal talks on nutrition and connected matters. The lecture with or without cinema or slides remains one of the most potent forms of propaganda.

319. *Posters*.—Posters will obviously often be most effective. But their value for propaganda purposes among the more primitive peoples of the Colonial Empire is a matter of some doubt and discussion. It seems likely that the more primitive the people the less effective is the poster, or at any rate the poster as we know it in Europe. Any words used will probably be most effective if they are on the lines of local proverbs. Any illustrations must be clear and simple, using only local figures and subjects, exemplifying a proverb, contrasting bad with good or telling a simple story.

320. *Broadcasting*.—Obviously broadcasting is a very potent means of welfare propaganda in European countries. Experience in the Colonial Empire is still somewhat limited. In some territories it is undoubtedly a useful means of propaganda, at any rate if the propaganda is combined with entertainment, and it is bound to become more useful. There are, however, various factors limiting the extent to which the wireless can be used for welfare purposes among backward people.

321. In the first place there is the question of cost. A special local broadcasting service cannot in most Colonial Dependencies be a paying proposition. It will usually require substantial assistance from Colonial Governments and it might well be found that, having regard to the cost, other means of propaganda would be more effective.

322. Secondly, unless special measures are taken, the circle of listeners will not be wide. In most colonial territories few people can afford receiving sets. If the mass of the people are to be reached communal wireless sets must be provided and maintained, and this again will be an expensive item\*. In Palestine central receivers connected to loud-speaker equipment have been installed in schools, halls, etc., in a number of large villages and welfare talks are given from the local broadcasting station. We understand that a similar system has been tried in parts of India and that so far as experience goes at present the broadcasts on, for instance, agricultural matters and market prices are widely listened to and appreciated. In Ceylon experiments with communal listening centres have recently been

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\* In Palestine the first cost of each receiving set was about £33 and the annual cost of maintenance about £16.



begun. Certain village schools have been provided with wireless sets and this has attracted the villagers in large numbers to "adult classes" whenever an attractive programme was offered. It is too early however to draw conclusions from the experiments so far made.

323. Thirdly, it is by no means certain to what extent broadcast propaganda "gets across" among colonial people. This is a factor which will naturally vary from territory to territory but it may be one of fundamental importance. In East Africa, for instance, it is doubtful whether the mass of Africans could be persuaded to listen to welfare talks after the initial novelty had worn off, and if they did, whether they would be able to profit from them. The movement and discourse might be too quick, the speakers too remote, the subject-matter not sufficiently applicable to their own circumstances for the lesson to strike home.

324. Finally, there is in many parts of the Colonial Empire the language difficulty. Broadcasting to be effective must be in the vernacular language. Often there will be a number of different vernaculars in one Dependency. This of course is a difficulty common to many forms of welfare propaganda, but it obviously affects broadcasting in particular.

325. For all these reasons, there is a considerable body of opinion which inclines to the view that at present broadcasting will not be found to be an economical or even a very effective means of welfare propaganda, at any rate among uneducated rural communities. At the same time it is too early to be at all dogmatic and it is quite possible that most of the difficulties mentioned above may be surmounted. In urban areas there seem to be considerable possibilities in "wire broadcasting"—that is, broadcasting along land lines, existing telephone wires often being used. By this means broadcasts can be efficiently made at relatively small capital and recurrent cost, and the system has worked successfully in several territories. The radius of diffusion is at present small, however, so that it is not suitable for use except in predominantly urban areas.

326. *The cinema and magic lantern*\*.—Somewhat the same considerations apply in the case of the cinema as in the case of broadcasting. Considerable expenditure is required, the film may not be sufficiently "localized" to appeal to the audience and the movement may be too quick for them to apprehend the lessons which it is desired to teach. Broadcasting has

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\* Since these paragraphs were in print our attention has been drawn to a new development which may have great importance. This is the film strip or film slide process, which appears to combine many of the advantages of the magic lantern and the cinema with few of their disadvantages. We understand that the Colonial Office is about to circulate full particulars to Colonial Governments.

the advantage over the cinema that a wider audience can be reached, but the cinema has this advantage over broadcasting, that the film must be presented by someone to each audience to whom it is shown. That person can be a person who knows his audience and can help in interpreting the film to them. Possibly too the difficulties mentioned above are more easily surmounted than in the case of broadcasting. No high degree of technical efficiency need be required and the small film made by the amateur with a little experience will often be quite good enough to convey the lesson desired. The cost of such films will be relatively small so that they can be more "localized", and some films can be stopped by the demonstrator to explain particular points. Moreover, the actual taking of the films might be good propaganda for the actors taking part. We suggest that colonial governments should consider assisting selected officials who show keenness for the work to obtain portable cinematograph cameras and to receive a little training in their use. We understand that the British Film Institute have recently published a pamphlet containing information as to the most suitable types of camera and projector, and that this has been circulated to colonial governments.

327. In a good many Colonial territories effective use of the cinema is already being made and films exist dealing with such things as malaria prevention, the importance of pure milk supplies, the danger to health from rats and flies, hookworm, maternity and child welfare, and rural sanitation generally. Malaya, Ceylon, Cyprus, Trinidad, Nigeria and other territories have all done a considerable amount of work on the subject, and in East Africa valuable experiments have recently been carried out by the Bantu Educational Cinema experimental team. A catalogue of films on public health matters made in Colonial territories has been prepared by the British Film Institute.

328. We should perhaps explain that in discussing the use of the cinema for propaganda purposes in the Colonies we assume that as a rule the cinema would come to the people rather than the people to the cinema. Travelling health vans equipped with portable cinema apparatus have been found most useful in various parts of the Colonial Empire. The films can be shown either in the open air or in any local hall that may be available.

329. The magic lantern may have decided advantages over the cinema in cheapness and in the fact that a smaller degree of technical efficiency is required and that the still picture can be explained in detail by the demonstrator at leisure. It seems at present to have definite advantages over the cinema in explaining technical processes. Even still pictures if they are to



be of the fullest value should represent local scenes and local people.\*

330. *The gramophone.* The gramophone with loud speaker may, we think, be a useful vehicle of propaganda. A record is cheap to produce; it can be repeated to an audience as often as desired; a record of the same lesson can be made in many different languages; and it can be explained by the demonstrator. It may often be used profitably in connection with a cinema film. Again, to produce the maximum of effect, records must be extremely local. The main requisite seems to be a cheap and portable machine for making records. We suggest that the Colonial Office should obtain information on this subject for distribution to Colonial Governments.

331. *Models.*—We think that models, that is houses and holdings which have been specially constructed and laid out to

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\* The following conclusions reached by the Conference of Colonial Directors of Agriculture held last July may be quoted here (Colonial Office publication No. 156) :—

The Conference desires to record that close attention to propaganda and publicity is necessary if satisfactory progress in extension work is to be achieved. It has examined the different systems in operation and concludes that the use of films and, in certain dependencies, broadcasting can form a useful adjunct for reinforcing normal extension activities and of attracting attention to them.

Films, for the purposes of agricultural propaganda and instruction, may be divided into three classes :—

(a) General interest films designed to secure the interest of the audience.

(b) Background films depicting familiar local scenes and operations designed to provide a background for more detailed instruction.

(c) Films aiming at detailed instruction in agricultural processes.

The Conference notes that up to the present time experience in certain dependencies appears to indicate that, with regard to category (c), detailed instruction in agricultural processes is better conveyed by means of still lantern pictures with a spoken commentary, but that there is need for further experiment on this point, while films under categories (a) and (b) appear to be valuable as an adjunct to detailed instruction whether by films or by slides.

The Conference considers that films under categories (b) and (c) can serve a useful purpose only if they are prepared with a precise regard to local circumstances and conditions, i.e., that in general they should be prepared locally or under local guidance from technical departments. The Conference further believes that it is in general practicable for Colonial Governments to prepare reasonably satisfactory films of this nature locally without importing expensive professional assistance. The possibility of securing help from selected amateurs interested in cinematography and professional assistance when it can be obtained cheaply should not be overlooked.

In any case propaganda or publicity through the medium of the film or broadcasting requires to be "followed up" intensively by extension workers if it is to secure a lasting measure of success and the Conference attaches importance to demonstrations and lectures at district shows, village council meetings and schools and to the organization of visits to agricultural and demonstration stations and selected farms.

exemplify the principles of hygiene and cultivation which it is desired to emphasise, will be found to be a most useful and effective form of propaganda. Generally the most useful kind of model will be found to be the permanent, full-size, working model, seen in action; the model house should be occupied by a picked family and the model holdings should be worked by them. The family should be under an obligation to take every opportunity to show their friends round; they should be able to explain the construction and use of the model, and advise others how to copy it. It is of fundamental importance that the models should be based on the traditional practice of the neighbourhood and that the aim should be, wherever possible, to adapt and not to alter it. Moreover, models should not embody alterations and improvements which are too elaborate and expensive and which the neighbours will not be able to copy; experience has shown that it is often a mistake to demonstrate too drastic an alteration; it will not be understood by those who see it and will therefore fail in its purpose. Demonstration must not be too far in advance of public opinion. All houses built by government for their employees should in themselves be models to the general public. Government should themselves set the standard to be followed.

332. *Demonstration plots and farms.*—An effective means of agricultural propaganda is the demonstration plot on which the effects of improved agricultural practices will be visible to all. Such demonstration plots should obviously be in places where they will attract attention. Only those things which are absolutely proved should be demonstrated—experiment and demonstration should be kept quite distinct. Instead of the Government demonstration plot, the Agricultural Department may find it preferable to carry out demonstrations on the land of selected individuals working under their supervision.

333. Agricultural and Veterinary Departments will normally run Agricultural Stations and Stock Farms both for research purposes and also for the provision of improved seed and planting material for distribution and of improved cattle, sheep, goats, and poultry. Producers should be encouraged to visit these Government stations and to make use of them and they may also provide useful object lessons.

334. *Health weeks and agricultural shows.*—There is no doubt that shows and “weeks” of all kinds provide a great impetus to social welfare work especially if they are not always held at the same centre, and we suggest that the effect is increased if they are a combined effort by all the agencies, official and unofficial, engaged in welfare work in the locality. Apart from anything else such joint enterprises provide a useful opportunity for co-operation and for each department to learn



what its fellows are doing; each gains in keenness from the example of the other. Some of the exhibits—for instance model homes and model holdings—will require many months to prepare.

335. Again we would emphasize that everything demonstrated must be of proved value, practical and within the powers and means of the people who will see it. The success of the whole “ week ” or show will largely depend upon the ability of demonstrators to show off the exhibits and explain them to the people, and the training of these demonstrators will in itself be good propaganda. Often shows will develop in a few years into a sort of fair. Some years ago, for instance, an Orange Day festival was started in parts of Cyprus with the object of stimulating local interest in citrus growing and the consumption of citrus fruit. It has now come to be a pageant followed by many side-shows, sports, the recitation of poems specially written for the occasion, dances and the like. Sometimes too it may be possible to combine the show with an already existing festival occasion, though if there is any danger of this providing a rival attraction a different date would obviously be preferable.

336. *Competitions, prizes.*—One feature of the shows mentioned above would normally be competitions, with prizes; these may be a very effective means of stimulating—and maintaining—interest in improved practices. One of the chief difficulties of all propaganda is to secure that the effect of the initial impact is maintained. The “ follow up ” of all propaganda is most important; otherwise much of the effort will be wasted. We suggest that the holding of annual competitions with prizes will be a most effective means of maintaining progress secured. The prizes should be practical: the prize for the best milch cow, for instance, should preferably be something that will be useful in animal husbandry, coupled probably with some medal or token that may be permanently prized.

## (ii) THE PERSONNEL REQUIRED.

337. It will, of course, be for the central Government of each territory to give the broad direction to social welfare work and to allocate funds for it. Beyond this the function of the central Government will be chiefly to encourage local effort and initiative. The actual carrying out of work must be a matter for each province or district or village. The more the interest of local authorities and the local population can be aroused the better, for welfare services which are spoon-fed by Government are not appreciated nearly so much as those in the creation of which the people themselves have taken a hand. There is thus full scope for individual initiative.

338. In his despatch of the 18th April, 1936, the Secretary of State recommended the setting up either of special nutrition committees or of general welfare committees in each territory of the Colonial Empire. Very often there will be advantage in having similar local committees, committees not only of officials, whether of the central Government or local authorities, but also of prominent members of the local community. A village welfare committee can be a most important agent in securing social betterment. Such committees already exist in several territories and have proved very valuable. They inspire the local community to take an interest in the work themselves and the plans of campaign are drawn up by the people, who thus do not feel that they are imposed upon them from above.

339. Other local organisations may also be used with profit. The co-operations of missionary societies would naturally be sought. Boy scouts and girl guides can often be enlisted to help, for social betterment work is eminently suitable for senior scouts and guides and would be assured of the warm support of the authorities of the movement. The Red Cross is another institution whose aid can often be invoked. In some territories it may be possible to start something approximating to the Women's Institute—i.e. a sort of women's club, meeting periodically, partly for recreational purposes and partly for talks and demonstrations on such things as infant welfare and domestic science. A very successful Womens' League has recently been started in Jamaica and is doing much good work. Somewhat similar Social Service Leagues are in existence in other territories. We have already mentioned in an earlier paragraph the idea of "readers' circles" which has recently been started in East Africa.

340. The local officials must necessarily be important agents in "getting across" welfare work. Whatever his substantive post, it should be a recognized obligation on every minor official stationed in country districts to take a part in fostering local welfare efforts. His home should be an example of the virtues of domestic science. His garden or holding should in itself demonstrate improved agricultural practice. In particular this applies to the school teacher. For these reasons alone we regard it as of the greatest importance that as many rural school teachers as possible should be trained in domestic science and agricultural subjects and, as we shall show later, we think that such subjects should normally form part of the curriculum in the schools themselves. These ideas are very far from being new; indeed the principle is generally accepted and in many parts of the Colonial Empire already a proportion of the teachers are trained at a "Jeanes" school or at an institution embody-



ing similar principles.\* There is, however, room for a far larger development of work of this kind, and we strongly recommend that all Colonial Governments and all missionary bodies engaged in education should make it their policy to see that teachers appointed for work in rural areas should have some knowledge of local agriculture, elementary hygiene and "home building," and that women teachers, whether in rural areas or not, should be qualified to teach the kind of domestic science applicable to local conditions.

341. Another important agent in welfare work is the health visitor, a local woman specially trained to advise parents on health matters generally and particularly regarding the health of pregnant women and of infants. Health visitors are at present at work in many parts of the Colonial Empire, and there is plenty of evidence to show that their services are appreciated and that they have a really big effect in decreasing infant and maternal mortality and in improving the nutrition of children generally. The health visitor is a comparatively new arrival even in European countries but one who, we consider, has amply proved her worth, and we recommend that Colonial Governments who have not so far done so should take every opportunity to develop a health visitor service.

342. Apart from the resident agents of the Government much can be done by travelling propaganda units. We have already referred to the useful work done by health vans with cinema apparatus. The activities of the staff of health vans need not be limited to the giving of cinema shows. With the aid of such movable units it is possible to make a concentrated propaganda drive upon one particular district over a short period of time. Malaya and Nigeria led the way in the use of travelling propaganda units and have found their work most valuable. Other Governments are now following their example and it is greatly to be hoped that others will do so in the future. The work of the travelling unit must be followed up by the resident officials in the area. Otherwise much of the value of its work will be lost.

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\* The "Jeanes" school is an application of the principles stated above. It derives its name from the fact that these principles have been intensively applied in the training of supervisors of negro schools, paid from the Jeanes Fund in the U.S.A. The courses last usually for two or three years and those taking them are usually accompanied by their wives and families. While naturally one object is to train each candidate in his special duties as a teacher, an equal importance is attached to securing that his whole household shall constitute in itself a model and an object lesson for the community among whom he is to work. Much valuable information on this and similar questions is to be found in the "Memorandum on the education of African communities", Colonial Office pamphlet No. 103, issued by H.M. Stationery Office 1935, Price 6d; and in "Overseas Education" published quarterly for the Secretary of State for the Colonies by the Oxford University Press, 1/- net.

343. In general it may well be that welfare propaganda will be more effective if a number of Departments concentrate together upon the same district. The Far Eastern Conference on Rural Hygiene, for instance, reached the conclusion that experience in India, Ceylon and elsewhere shows that health work in rural districts is productive of excellent results if it is carried on in an intensive way in limited areas. In Ceylon what are known as health units are now permanently at work in 11 areas covering over 800,000 people or about a sixth of the whole population. These units, the first of which started in 1926, are each in charge of a Medical Officer of Health who has a staff of Sanitary Inspectors, Public Health Nurses and Midwives under his control. They carry out a programme of health propaganda work covering all aspects of community and individual hygiene. They cover 63 maternity and child welfare centres,\* as well as work at all the normal activities of Health Departments. "Health weeks" are carried out and several thousand talks and lectures given in schools, villages and clinics, some with lanterns or films.

344. Similarly, a very carefully thought out rural development scheme involving joint action by agricultural, veterinary, education and health authorities as well as by unofficial organisations and the people themselves is now being introduced in eighteen villages in Cyprus.† Somewhat similar work is already being done in Macedonia by the Near East Foundation, who are taking a lively interest in the scheme. Further examples could be given from other parts of the Colonial Empire. We suggest that other Colonial Governments might find these examples worthy of imitation.

345. We suggest also that Colonial Governments should do their best to interest prominent local residents and, perhaps particularly, the wives of officials in local welfare work, especially among women. The wives of civil servants have often that rare commodity, leisure, at their disposal and they can do much to assist local populations. We have suggested earlier that organisations on the lines of the women's institutes in this country might be started in some territories, and we have referred to the valuable work of the Women's Welfare League in Jamaica. In organisations such as these and infant welfare centres the wives of Government officials can and often do play an important part.

346. We have suggested elsewhere in this report that employers of labour should be encouraged to pay more attention to the proper feeding of labour. Apart from the immediate

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\* It has incidentally been discovered that better attendances are obtained if ante-natal clinics are held at different times from baby clinics.

† See "Proposed Rural Development Scheme", Memorandum by B. J. Weston, Cyprus Government Press, Nicosia.



benefit to the employed—and thus to the employer—we think that this should have considerable propaganda value, for the employee who has been well fed and well housed for say six months at a time will be more inclined to insist upon better standards for himself when he returns to his home. Similarly Government institutions, such as hospitals, and even prisons, have a very considerable propaganda value in improving standards of nutrition. It should go without saying that the diets provided in Government institutions should be such as will be adequate for good nutrition. A great deal has been done to improve these diets in recent years. Hospitals can often arrange to have their own vegetable gardens where convalescent patients will see the vegetables they are given being grown. During their stay in hospital they will become accustomed to eat these vegetables and the present of a packet of seeds when they leave may lead them to grow them for themselves when they go home.

347. This section of our report would not be complete if we did not refer to the obvious fact that the success of social welfare work depends largely upon the officers of Government or local authority understanding and obtaining the confidence of the people among whom they work. The best intentioned efforts will break down in the face of the passive resistance of the people it is sought to assist. Conversely if the people trust the author of a new idea, they will often adopt it with surprising readiness.

348. Finally, mention must be made of the role of co-operative societies in schemes for rural betterment. The co-operative movement has achieved a fair degree of success in some parts of the Colonial Empire, though it has not yet played the important part in any Colonial Dependency that it plays in some other countries. The existing societies in the Colonial Empire are mostly concerned with the provision of credit and thrift facilities to their members or with the marketing of their produce or with both of these two activities. But a few societies have been formed in Malaya and Ceylon having for their object the improvement of village conditions and general rural betterment. A great deal of good has been done by such societies as these in other countries, and undoubtedly they could be most valuable in the Colonial Empire. We hope that Colonial Governments may find means of extending the movement as quickly as is possible consistently with adequate supervision. Perhaps the greatest value of co-operative societies lies in the fact that they are an effort of the people to help themselves. They therefore take a personal interest in their success. Moreover, whatever its object, each society consists of a group of people who have to some extent at any rate appreciated the need for communal action and the advantages it brings. Its members are therefore likely to be receptive of

new ideas in other directions. Co-operative societies are thus valuable as centres for propaganda and the dissemination of information, whatever may be their immediate objective.

### (iii) GENERAL PRINCIPLES.

349. Without wishing to be too dogmatic on a subject which has been too little explored to permit of much dogmatism, we suggest that the following general principles emerge from our survey of the means and agents of welfare propaganda. We suggest that they should be taken into account by anyone who has to plan welfare propaganda:—

(1) Changes will be more readily accepted if they are not regarded as having been imposed from above. The people themselves or at least their leaders must be inspired to make the changes of their own accord.

(2) The type of propaganda to be used will vary according to whether the whole community must be converted before a change can be effective or whether it will suffice to convert in the first place only a few individuals.

(3) A dramatic improvement, such for instance as results from a campaign against yaws, will be invaluable in winning the confidence of the people.

(4) The least intelligent members of the community can perhaps only be reached by means of the more intelligent. Convert the more intelligent first and they will convert the masses.\*

(5) Use to the full the influence of any local aristocracy or leaders. If they are not used as leaders of advance, they will almost inevitably become leaders of reaction.

(6) If people are to be inspired to make changes of their own accord, they must fully understand them. Propaganda then must be devoted (*a*) to making the more intelligent members of the community understand what changes are wanted and (*b*) to inspiring them to carry them out.

(7) Older people often have more power in the community than the younger people. But the young people of to-day will be the older people of to-morrow. Other things being equal, a pound spent in changing the habits of those who may well live 40 years will be more economically spent than a pound spent on those who can hardly live ten. At the same time the young man will find it hard to retain his enlightened ideas if he is constantly subjected to grinding discouragement from reactionary elders.

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\* This needs some qualification. The man who has been so educated as to have lost touch with his original environment will obviously not have much power to influence those who have remained in that environment.



(8) Most forms of propaganda should be directed primarily to the women and more particularly to the mothers. It may then be effective from generation to generation whereas the effect of propaganda on a man may die with him.

(9) Ocular demonstration is much more effective than any amount of explanation. If people see that the crop grown on a particular piece of land with improved methods of cultivation is better than that grown on the next piece of land by the ordinary methods, they will copy the new methods, provided that they can understand them and that they are not too far removed from those to which they are accustomed. In other words,

(10) Exploit the power of the illiterate to imitate.

(11) Hasten slowly. It is no use telling people that their children will never be healthy until they drink a pint of milk a day, if at present they are subject to taboos which prevent their drinking milk at all, or if the price of a pint of milk is equivalent to the earnings of a family for a week. Make sure that any changes recommended are practicable.

(12) Demonstrate and recommend only that which has been fully proved by experiment. Do not recommend people to plant a new crop if there is any risk that when they have begun to take the advice it will be found that it will not grow in that particular area.

(13) All propaganda must be immediately applicable to the people to whom it is directed. The more primitive the people, the more essential this is. In East Africa for instance a film depicting tribe A will probably convey little if shown to tribe B.

(14) The *tempo* of propaganda must be adjusted to the power of the people to take it in. There is evidence for instance to show that the magic lantern is sometimes more effective than the cinema, because the cinema moves too quickly for its lessons to be assimilated.

(15) It is a mistake to try to introduce too many innovations at once. If you do, people will be frightened and the power of the reactionaries will be strengthened.

(16) At the same time the power of a people to progress in one direction will be limited by their ignorance in other directions. For instance no infant welfare campaign can be entirely successful so long as general housing conditions remain insanitary. All aspects of public welfare react upon one another.

(17) Repetition without causing boredom is the essence of propaganda. The same lesson repeated ten times in

slightly different form is more than ten times as effective as a single lesson.

(18) For this reason effort diffused will often be effort wasted. The objects of a propaganda campaign should be clearly defined, concrete and concise.

(19) Make sure that the limited money available is being spent to the best advantage. Before, for instance, beginning the taking of an expensive film, consider whether the same object could not be as effectively obtained for less money by means of, say, gramophone records and magic lantern slides.

(20) Propaganda concentrated upon one district, carried out by several departments working together, and with a few clearly defined objectives, will often be the most effective.

(21) Always take great care to follow up a campaign; otherwise ground gained may subsequently be lost and much of the effort be wasted.

### (c) THE EDUCATION OF THE YOUNG.

350. We have considered at some length the subject of community education, that is the education of the adult in social welfare matters and the means of securing it. The education of the younger generation on social welfare matters is only the particular application of the principles laid down above; it will not therefore be necessary to add much in this part of our report.

351. It will, we think, be sufficiently obvious from what has been said elsewhere in this report that consideration of the factor of nutrition emphasizes the importance of education being environmental in character; that is to say, it should not be purely literary but should have a direct application to and bearing on the circumstances in which the children of each territory live. It follows from this that we attach the greatest importance to the teaching of agriculture to pupils in rural areas, in mission schools as well as in government schools.

352. For any agricultural teaching to be effective, there must be the possibility of practical demonstration. The school garden or farm is therefore a necessity to rural education. It should be a place where the children not only learn the principles of sound agriculture but also how to grow food crops of nutritive value. The school garden should also be linked with teaching in cooking and domestic science, and where possible the children should themselves cook and eat the food they grow.

353. A variation of the school garden system which has been tried with success in some Colonies in what is known as the



“home garden” or “project system,” whereby the parents of the children are induced to give them a set portion of the family land to cultivate and the children cultivate it under the supervision of their teacher. One advantage of this idea is that it brings the parents also into contact with the improved agricultural practice which is taught to their children. Obviously, however, it can only be adopted where the community live fairly close to the school.

354. It is hardly an exaggeration to say that in some cases the main purpose of the school should be to improve the agriculture of the people and that in the early stages other education should be subsidiary to this main theme. One example may be given from the Suk district of Kenya. The people inhabiting that district are pastoralists by tradition who have now much reduced quantities of cattle. In 1930 the only crops grown in the district were two kinds of millet, sorghum and finger millet. In years of drought the district suffered from serious food shortage. In 1930, after considerable enquiry and discussion, the Education Department decided to start a boarding school for 40 boys. The boys were to clear and cultivate a plot of land round the school and to grow on it a crop of potatoes and other vegetables. In addition a certain amount of instruction in the three Rs was given and they obtained the discipline of boarding school life. The first crop grown on the communal plot was a great success. The boys became so keen that they asked to have their own gardens. After a year or two it was possible, with the help of the boys, to start demonstration plots in various parts of the district. Despite many difficulties these too eventually proved a success. Every opportunity was taken to show the plots to the general community. For instance, the meetings of the Local Native Council were always held at the plots. By 1936 considerable quantities of yellow maize, white maize, ground nuts, sweet potatoes, European potatoes, several varieties of beans and pulses, cassava, sesame, yams, carrots, onions and tomatoes were being grown where, six years before, nothing but millet had been grown. The improvement in the physique of the tribe was remarkable and there was beginning to be a surplus of vegetables for export to other parts of Kenya. Moreover a beginning had been made in checking soil erosion by, for instance, planting sweet potatoes in strips on hillsides.

355. As rural children should be taught agriculture, so all children whether in town or country must be taught the elements of hygiene and health—personal cleanliness and so on. Similarly for the girls the teaching of domestic science in all its branches should be one of the most important parts of the curriculum. Those aspects of it which particularly concern us are cookery classes and the teaching of infant and child welfare. We should like to see a very great development of both these aspects. We

deal in the next section with the importance of infant welfare work, but we think that the beginning of training in the subject should most certainly be given in all schools for girls.

356. We have emphasised that from a nutritional point of view education should be environmental, but it is also necessary to bear in mind the close and very real connection between the application of intelligent methods in agriculture and domestic science on the one hand and an improvement in general intelligence on the other. It is a mistake to over-emphasise environmental education to the exclusion of general education. In the case of girls, for instance, it is a constant complaint, repeated from many Colonies, that it is impossible to develop a service of health visitors, midwives, nurses and so forth because it is impossible to obtain girls with sufficient general education to assimilate special instruction on these matters. As we have already said it is quite as important, if not more so, to educate the women of the community as to educate the men and we feel that female education has received insufficient attention in the past.

357. Considerations of finance limit the extent to which general education can be given—in most Colonies the days of universal education are unfortunately still remote—but much thought is now being given to the possibility of reducing the cost per pupil of elementary education and so making possible an increase in its range. Probably the most important factor is the training of more local personnel.

358. If more teaching is to be given on agriculture, health and domestic science, the first requisite is the better training of teachers in these subjects. We think that so far as girls' education is concerned the teaching could probably best be given by women teachers. Some territories—for instance Palestine—already give a good deal of attention to the training of teachers in "environmental" subjects. Some territories also already employ considerable numbers of women teachers and have special training colleges for them. In Palestine there are two colleges, one for teachers who are going to be employed in urban schools and the other for those who will be employed in the country. In some parts of the Colonial Empire, however, little progress has been made either in "environmental" training or in the employment of women teachers. The report from one Colony in the West Indian area, for instance, shows that in the past little or nothing has been done to train teachers either in agriculture or in domestic science. Similar instances could be given from many other Colonies.

359. There should be relatively little difficulty in arranging for the training of teachers in agriculture, for it should generally be possible for a member of the Agricultural Department to take



on this work. In the case of domestic science and health work among women generally, however, there may at present be no one in Government employment who could arrange and supervise training courses. The task is obviously one for which women are much more suitable than men, and it may be necessary to appoint someone specially from outside the territory. We suggest that it should be possible to find suitable persons in this country who have, amongst other things, taken a diploma in dietetics. Sometimes it might be possible to make a beginning by enlisting on a voluntary or semi-voluntary basis the services of a local resident with some knowledge of domestic science.

(d) MEALS FOR SCHOOL CHILDREN.

360. It is now beginning to be realised that it is uneconomic to attempt to teach children who are too poorly nourished to be able properly to assimilate the teaching given. We have already quoted the report from Barbados that many children have no regular meals after Wednesday in each week because the family wage is exhausted. Barbados have now made a beginning in the feeding of school children, and a sum of over £10,000 was provided in the estimates for 1938 for the purpose—a sum which is considerable for a territory of the size of Barbados. From Zanzibar similar reports come. In the report received it is said: “ The routine medical examination of the rural schoolboys displays the fact that a very large number of children are under-nourished and that in many the grossest physical signs of avitaminosis are evident. On questioning the children it is usual to find that only comparatively few have had a satisfactory meal, and some have had no food at all before coming to school. In many places it is not uncommon that the majority will have no regular food until the evening meal is cooked at dusk; one meal a day is the rule and not the exception.” The report goes on to emphasise the importance of providing a meal for the school children and a beginning in this direction has now been made. In Ceylon no less a sum than Rs.1 million is being spent by the Central Government on the provision of nutritionally adequate meals to some 80,000 school children. Local authorities and voluntary agencies also provide meals for school children and in all, the children in 520 different schools are now receiving mid-day meals. In Jamaica a voluntary “ Children’s Lunch Fund ” provided lunches in 1937 to about 500 children a day in Kingston, or about 4 per cent. of the children on the rolls of the elementary schools. The fund is now being assisted by a Government grant. There are also 23 school canteens in rural areas operated by the teachers in conjunction with the kitchen gardens at these schools. The scheme, which is assisted by the Jamaica Women’s League, also receives financial assistance from the Government. In British

Guiana a scheme for the provision of extra milk to a selected group of school children has recently been started. Many other instances could be given of a beginning being made in work on this subject.

361. We commend these examples to Colonial governments. The great limiting factor is, of course, the cost. This is considerable and in many Colonial territories it would be impracticable to provide food for anything like the number of children at present going to school, even though that number may be only a fraction of the total children in the territory. In rural areas a good deal could be done by using the produce of the school gardens, which we consider should be universally attached to rural schools. Elsewhere it may be possible to make a small charge. For instance, in Freetown, Sierra Leone, some of the schools have arranged for the supply of a mid-day meal by a contractor at a charge of 1d. a day to each child. The constituents of the meal accord with suggestions made by the Health Department. Apart from the provision of this proper meal no other food, e.g., sweetmeats, etc., may be sold in the school compounds. We suggest that the system of providing food against payment might well be copied in other parts of the Colonial Empire where the parents would normally have to buy food for their children. Apart from the reduction in cost there may be something to be said for requiring a small payment for meals provided, in that it does not decrease the sense of responsibility of the parents for the wellbeing of their children.

362. Cost being so important a factor, it is naturally desirable that the maximum amount of nutritive value should be obtained for a minimum amount of money. It may be that here there is a large scope for the use of dried skimmed milk imported in bulk, or of concentrated foodstuffs in one form or another. We have referred to this matter in Chapter VIII, paragraphs 176-79 and 184-89.

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## CHAPTER XIII.

PRE-NATAL SERVICES AND INFANT WELFARE  
WORK.

363. We now come to a part of the subject which we believe offers great scope for immediate improvement. We have tried to show in Chapter III above that pregnancy and lactation on the one hand and infancy and childhood on the other are from a nutritional point of view of outstanding importance. There can be no doubt that ignorance on the subject of nutrition, as indeed on all other aspects of health, is responsible for much preventable sickness and mortality during these periods.

364. As regards the infant, it would obviously be wrong to ascribe the appallingly high infant mortality rates which now exist in some parts of the Colonial Empire solely to malnutrition, since obviously where malaria, congenital diseases, hook-worm and other infestations are very prevalent these must also play a significant role in the state of well-being of the child. There seems to us, however, to be no reasonable doubt that malnutrition mainly resulting from unsuitable feeding is one of the most important factors in causing high infant mortality in tropical countries. On the one hand there is ample evidence that at all times digestive troubles are one of the primary causes of infant mortality. On the other hand there is ample evidence that throughout the Colonial Empire many infants are fed most unsuitably. For instance, in Swaziland and in many other parts of Africa it is the custom to give babies sour porridge during the first week of life in addition to breast milk. In some of the West Indian Colonies infants are weaned at one to three months, and thereafter are fed on sugar tea and corn meal pap, with the addition of potatoes, rice and biscuits as they grow older. Many other similar examples could be given.

We have no doubt that improved feeding of infants would lead to a great reduction of infant mortality rates.

365. The reasons for the improper feeding of nursing mothers and children in the Colonies are not far to seek. In part it is due to one or other of the various aspects of poverty with which we have dealt in previous sections. In part it is due, at any rate in the West Indies, to the high percentage of illegitimacy due to casual unions. But when due allowance has been made

for these causes there can be no doubt that sheer ignorance is one of the chief factors.

366. This, though it may seem paradoxical, is encouraging, for it means that it is possible to make considerable progress at the present economic level. There can be no doubt that in general the women of the Colonial Empire welcome instruction on infant welfare work, and that it is only necessary for instruction—enlightened, sympathetic and understanding—to be given for real progress to be made. Thus without any change in the economic level it should be possible everywhere to reduce infant mortality rates very considerably by increased attention to infant welfare and particularly to the feeding of mother and child.

367. When it is realised that infant mortality at present exceeds 200 per thousand live births in many parts of the Colonial Empire, and sometimes even exceeds 300 per thousand, it will be seen that the field of work is great. Excellent work is already being done in almost every part of the Colonial Empire but even where the services have been most developed they at present touch only a small fraction of the whole population. We think that Colonial Governments would find that on any long view increased attention to infant welfare work was one of the most productive forms of expenditure. It should lead to increased efficiency in production and decreased expenditure on medical services; where shortage of population is a problem, it should lead to an increase. It is probably one of the cheapest forms of attack on many tropical diseases, malaria amongst them. We recommend therefore that Colonial Governments should greatly extend infant welfare work. We recognise that the funds available are strictly limited. We suggest therefore that they should invoke the assistance of voluntary workers wherever possible. The subject is one on which voluntary workers can be of great assistance; indeed much of the work already being done is being done by missions or owes its beginning to the enterprise of the wives of officials and prominent local residents. Further we suggest that in those countries where it is customary for the labourer on estates or mines to be accompanied by his family, the estate or mine should be encouraged to provide infant welfare facilities. Some already do this in varying degrees.

368. There will of course be many other subjects for the infant welfare worker to deal with besides the actual feeding of the child, but we feel that in the conditions of the Colonial Empire the first lesson which must be taught is the importance of breast-feeding without the addition of other unsuitable food. The Final Report of the Mixed Committee of the League of Nations says: "Complete breast-feeding of infants is of very great importance. It is cheaper, simpler and cleaner than



artificial feeding and in the case of a properly fed mother the benefits brought to the infant are great '\*'. This conclusion was applicable of course primarily to temperate countries, but we consider that it applies even more strongly to Colonial conditions where the difficulties, economic and hygienic, of securing a proper artificial food supply must be so much greater. In large parts of the Colonial Empire breast-feeding is the rule and may last as much as two years and even longer. Nearly always, however, at the same time the child is given unsuitable solid food. It is this which is the main cause of digestive troubles.

369. But the whole problem has not been solved when breast-feeding has become the rule; it is merely thrown back from the child to the mother. As we have seen the nursing mother herself requires a diet very considerably above that of the ordinary adult, and unless she gets it the health of her child may suffer as well as her own health. It is important therefore that instruction in infant welfare should include instruction to mothers as to their own diet during lactation.

370. Moreover the problem does not end with weaning; it is important that instruction should also be given in the proper dietary of children after they are weaned. The activities of infant welfare workers should not be confined to infants in arms but should if possible be carried further, to cover children up at any rate to the school age†. During this period, as we have shown in Chapter III, children have certain special requirements beyond those of the adult. The period is one in which there is great susceptibility to infection and in the absence of proper nutrition this susceptibility will be greatly increased. It is often found that when children come to be examined by the School Medical Officer many have developed defects that have arisen during the pre-school period, either directly from malnutrition or indirectly from infection resulting from malnutrition, and that by the time these defects are seen it is too late to remedy them. As in the case of adults, it will of course be found that diets regarded as optimum by European standards are quite beyond the means of the majority of the local population. In advising mothers regarding the diets of their children it will be useless to prescribe foods which however desirable in themselves absorb an unduly large proportion

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\* Pages 68-69.

† In Malaya it is the general practice for children to be breast-fed up to the age of six months. At that age they are weaned. Experiments carried out in Singapore show that up to the age of six months the weight of babies coincides with European standards. It is only after weaning and the transference to white polished rice unsupplemented with milk that a falling off occurs, until at sixteen years of age Chinese are 18 per cent., Malays 13 per cent., and Eurasians 10 per cent. below European standard. It is not possible to say whether these differences are due to diet or heredity, but it is certainly possible that they may be due to diet.



of their income. The diets recommended must be diets which it is practicable for the parents to provide.

371. As regards the means of promoting infant welfare work, it is not necessary for us to go into detail. Ante-natal and infant welfare clinics, health visitors and propaganda on the lines we have discussed earlier should all play their part. Information from certain Dependencies suggests that little progress can be made in infant welfare work until more trained local women are available, and this in its turn presupposes a higher standard of general education than is usually obtainable among women at present. Once more we come back to the importance of increased attention to female education.

372. One factor which is a very important cause of malnutrition in the West Indies, in some African towns and in one or two other parts of the Colonial Empire, is the absence in the parents of a sense of responsibility for the welfare of their children. In the primitive community there is normally a clear obligation on one or other of the parents to look after their children. Where however the primitive sanctions no longer obtain, the obligation is apt to be disregarded. The sanctions of the primitive organisation are not immediately replaced by the sense of responsibility that obtains in the normal civilised community. In the West Indies for instance many of the children are the result of casual unions. The father accepts no responsibility for their welfare and the whole burden of it falls on the mother. She may well be unable to depend on any regular earnings and as often as not will have to work for wages herself. The children are often not wanted and even if they are wanted the mother will be unable to give them proper attention. She will often for instance be unable to breast-feed her babies for to do so would interfere with her power to earn money for their upkeep.

373. This state of affairs constitutes a social problem of the first magnitude and is linked with the general need for developing the social and economic conditions making for a more stable family existence. We consider that in almost all the West Indian islands one of the first aims of Government should be to educate their people in the duties of parenthood. This is of course important from many points of view besides that of nutrition. Amongst other things we think it may well provide the clue to the problem of the increase of population—an increase which with greater attention to infant welfare services will be all the quicker—for an increased sense of parental responsibility should lead to a reduction in the birth rate. The whole subject is one to which we do not doubt that the West India Royal Commission will devote much attention and we need not consider it further here.



374. Our primary concern in this chapter has naturally been with malnutrition as a factor in infant mortality and sickness. It is obvious that there are also other factors. The infant mortality rate in any place is usually regarded as a clear and reliable index of the state of public health in that area and where it is high, and intrinsically and climatically the area should not be an unhealthy one, it must be accepted as an indication that special action is called for on general public health work as well as on the nutritional aspect. The proper feeding of infants and young children can only yield its full results if they are preserved from concurrent infections.

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## CHAPTER XIV.

## THE NEED FOR FURTHER KNOWLEDGE.

375. The preceding chapters of our report have been concerned with an analysis of the problem of nutrition in the Colonial Empire as it appears in the light of existing knowledge, and with an attempt to define the directions in which a practical advance towards better conditions can be achieved. In the course of that analysis it has become evident that there is much that can and should be done to effect an improvement at the present time on the basis of the knowledge already available. Some of the deficiencies which exist are sufficiently evident and the task of remedying them does not call for further scientific investigation. At the same time no one who undertakes to study, as we have done, the evidence which is available regarding the nutrition of colonial peoples can fail to be deeply impressed by the great range and complexity of the problem and by the extent to which our knowledge of it is still imperfect and incomplete. The general outline of the picture may be clear enough, but much of the detail is lacking or can be filled in only by intelligent conjecture. Or again where the facts of the problem are clear the solution may still await discovery. However important, therefore, may be its political and administrative aspects, the problem of malnutrition is still to a considerable degree also a scientific problem. New knowledge is required in a field which is still comparatively unexplored. To stimulate the growth of such knowledge must be amongst the first aims of government policy.

376. This need was rightly recognised in the circular despatch addressed in 1936 to all colonial governments by the Secretary of State for the Colonies, and the matters on which governments were explicitly requested to report included the present knowledge of human nutrition in each dependency and the further studies and researches on the subject which appeared desirable. A full summary of the replies received from the various governments under these two heads is included in the survey which forms Part II of our report. At an early stage in our inquiry we took steps to consider what action might be taken in the light of this information. It appeared to us that the organisation of research was essentially a question on which assistance might be given to Colonial Governments from the centre. Research must of course to a large extent be carried out locally by personnel of the local Government. Nevertheless there was, we



felt, a great need for co-ordination, for some attempt to formulate a single scheme capable of application to the widely varying needs and conditions of the Colonial Empire. We accordingly appointed a Research Sub-Committee under the Chairmanship of Sir Edward Mellanby to prepare for our consideration a co-ordinated plan of field surveys and research which might with advantage be carried out. In the following paragraphs we summarize in broad outline the conclusions reached by the Research Sub-Committee.

377. The Research Sub-Committee began by observing that a distinction may be drawn between laboratory research of a more or less elaborate kind and field surveys of nutrition in relation to health. The facilities available for work of the former character are naturally confined to one or two laboratories in the larger colonial territories, such as Malaya, Kenya and Nigeria. In all of these laboratory research on nutritional questions has been actively prosecuted.

378. Two main questions have been investigated, the composition of local foodstuffs and the determination of the basic metabolic rate. In Malaya, as the result of the very thorough work done by Rosedale and others, information is now available regarding the composition and relative values of the local foods. In Kenya the chemical composition of local foodstuffs has been extensively studied, analytical data being available in a number of publications. In Nigeria the composition of local foodstuffs has been determined in the Government Nutritional Laboratory at Katsina. In regard to Ceylon, mineral analyses and vitamin assays of all the most commonly used local foodstuffs have recently been carried out in this country on samples specially sent from Ceylon. To these investigations may be added the important work which has been undertaken by the Imperial Bureau of Animal Nutrition who in their Technical Communication No. 6 have published valuable data regarding the composition of African foodstuffs.

379. The second main question which has been investigated in the laboratory is that of basal metabolic rates and energy exchange. In Malaya it has been found that the average Asiatic inhabitant has a basal metabolic rate about 10 per cent. lower than that of the normal European. Further it appears that the basal metabolic rate of the European becomes lowered in Malaya and can be raised by leave in Europe and even by local leave at a hill station. The conclusions which these investigations suggest is that environmental conditions are a more important factor than race in determining the level of the basal metabolic rate. In addition to the work done on basal metabolic rates in Malaya, the question of energy exchange amongst East African peoples is being studied in the Medical Research Laboratory at Nairobi.



380. The second of the two main heads under which nutrition research in the Colonial Empire may be grouped is that of nutritional survey work. This includes (i) field surveys, the purpose of which is to determine what the people eat and the state of their physique, (ii) studies on the relation between diet and disease carried out where groups of people are provided with food by Government or other responsible body, as in hospitals, prisons, police and military forces, labour on mines and estates, (iii) observations on specific deficiency disease conditions encountered by medical officers in the course of their day-to-day work.

381. Dietary surveys were begun in Nigeria by McCulloch in 1927 under the auspices of the medical department, and have been continued since that date by Turner, Fitzgerald-Moore, and Clark. They are being pursued, at the present time, by the Medical Officer in charge of dietetics research. One of the most comprehensive and best known field surveys of African dietaries was that undertaken in Kenya by Orr and Gilks relating to the physique and health of two contrasted tribes, the Masai and the Kikuyu, which although inhabiting adjoining territories have entirely different dietary habits. Investigations in Kenya include also a good deal of work falling under the second and third of the heads mentioned in the previous paragraph. Much important work on nutrition has been done in Uganda during recent years, and a valuable series of papers has been published by Loewenthal, Mitchell, Owen, Hennessey and others, dealing with such subjects as vitamin deficiencies in Uganda prisons, the ulcer syndrome in Uganda and vitamin A deficiency among the population of Teso. Further surveys are in progress and the Government are detailing a medical officer who will give his whole time to the work.

382. A noteworthy survey was that carried out in Northern Rhodesia by Gore Brown and by Richards and Widdowson among the Bemba, a millet-eating tribe inhabiting the high north-eastern plateau. Detailed observations were made of the dietary customs of the tribe and very careful records were kept of food consumption and cooking practices. The samples of food obtained were subjected to analysis in the Biochemical Department of King's College Hospital, London. Conditions in the millet-eating villages of the Bemba tribe were also compared with those in a typical cassava and fish-eating village situated in the territory of the Bisa.

383. In Basutoland and Swaziland, valuable studies of dietary conditions have been carried out by Ashton and Kuyper respectively. In Malta data have been collected by the local nutrition committee on the composition of the diet of working-class families in various villages and towns, and family budget studies have been undertaken by the Labour Department. In Palestine



surveys of the diets of certain Arab and Jewish communities have been undertaken by MacLennan and Kligler respectively.

384. An important nutritional survey was undertaken in Ceylon by Nicholls whose main studies consisted of an investigation of the diets of children in upper, middle and poorer class schools. The diets of 16 labouring coolie families were studied in detail and compared with those recorded in studies made in the Netherlands East Indies of the diets of Javanese peasants.

385. In Malaya the knowledge available regarding the dietary conditions of the population as a whole is not as extensive and complete as that available regarding the mineral and vitamin content of tropical foodstuffs. A beginning has, however, been made with the collection of the necessary data, and an investigation into dietary standards in Kedah has been carried out by Strahan. A report on nutrition amongst Malays in coastal districts has also been prepared by Burgess.

386. Finally, in Trinidad investigations have been carried out during the last fifteen years by Lassalle, Seagar and Clark. Seagar studied food consumption by industrial workers on cacao and sugar estates on which both East Indians and West Indians were employed. Clark who has done much work in the Colonies (notably in Nigeria) on the toxic principles which occur in underground foods, was engaged for some time in Trinidad on an examination of the relationship between diet and the occurrence of nephritis. In Jamaica also an inquiry has been carried out on the nutrition of children in the corporate area of Kingston and St. Andrew.

387. From the foregoing survey of the present position of nutrition research in the Colonial Empire certain salient features appeared to the Research Sub-Committee to emerge. In the first place, although work on nutrition has been going on in various parts of the Colonial Empire for many years and valuable contributions to our knowledge of the subject have thus been made, nevertheless there is a very noticeable inequality in the amount and nature of the knowledge available not only as between one territory and another but also, in some of the larger dependencies, as between different areas in the same territory. The progress of nutrition research in the past has depended partly on local or individual initiative, partly on a series of special investigations of particular questions financed from this country. No concerted attempt has hitherto been made to secure a general advance over a wide field. Secondly, and perhaps as a natural result of this circumstance there has been a tendency for research to develop disproportionately as regards the amount of attention devoted to particular problems.



It is natural that individual workers, carrying on their investigations more or less independently and with limited resources, should become interested in one particular line of inquiry and should concentrate their attention on the solution of a comparatively narrow range of questions. What is necessary, therefore, at the present time is to provide, so far as possible, for the acquisition over the whole extent of the Colonial Empire of a knowledge of the elementary facts of the situation in regard to nutrition. There are of course territories in which such knowledge is to a considerable extent already available. But even in those where most has been done there are gaps to be filled. In particular there is a lack of data derived from direct quantitative observations of the dietaries of the peoples of the Empire, with which few exceptions (e.g., among the Bemba in Northern Rhodesia, in Basutoland and Swaziland), have not so far been attempted. The lack of such information is particularly marked in the less developed territories where such observations are naturally more difficult to carry out.

388. In the light of the foregoing observations the Research Sub-Committee did not consider that the chief need at the present time is for elaborate laboratory research on such questions as the basal metabolic rates of tropical races. The work which has been already carried out, for example, by Rosedale and others in Malaya has sufficiently shown that the contrast with European conditions is not great enough to exercise an appreciable effect on the question of dietary standards. Moreover the average diet in tropical countries in present conditions falls so far short of the ideal that it is of secondary importance to lay down in precise terms what the ideal diet should be. Economic conditions alone would make it impossible of attainment within a reasonable time. The Sub-Committee did not propose, therefore, any considerable extension at the present time of the scale on which laboratory research is now being carried on in the Colonial Empire, though where facilities are available investigations which show promise of useful results will no doubt be continued.

389. The main need, the Sub-Committee felt, was for field survey work, embracing within that term studies of the diet of both rural and urban peoples including labour employed by mines and plantations. They recognised that there would be considerable variations in the methods and objects of such surveys in different territories. In some of the dependencies where the conditions of life are comparatively advanced, government officers are already broadly familiar with the composition of the local dietary. In territories such as these it will be possible to use the information already available as a basis on which to carry out more specialised inquiries into such questions as the relation between diet and disease or the relation between



diet and income. In other territories, as for example in parts of tropical Africa, even those familiar with local conditions have only an incomplete knowledge of the influences determining the diet of the indigenous tribes. In these cases, field surveys should include a study of the living conditions of the people and must embrace in the range of inquiry such questions as methods of producing, storing and preparing food, systems of land tenure, the organisation of labour, and of distribution, sale and exchange, incentives to work under modern conditions and the various tribal eating customs and magico-religious attitudes towards the use of foods. Obviously, a somewhat different personnel will be required to carry out surveys in these two contrasted types of territory. Moreover, the technique of dietary surveys must be adapted to the varying circumstances in which they are to be carried out. Amongst backward and illiterate peoples special problems are presented by such factors as the absence of the use of money or of units of measurement either of size or of weight. Seasonal changes of considerable importance also occur in the food consumed in many areas.

390. Again a differing emphasis may be laid according to local conditions on the various aspects of the nutrition problem. In the large majority of Colonial territories the agricultural side of the survey will be of much importance. The survey of health and agriculture carried out in the Teso district of Uganda may be quoted as an instance. In this case statistical evidence suggested that the presence of fish in the diet of one of the two areas compared was one of the main causes of the superior health (probably referable mainly to the absence of ulcer) observed in that area. The results of the inquiry suggested that steps should, therefore, be taken to increase the amount of animal food or fish consumed. For this purpose, it was suggested that further surveys would be desirable to determine the effect, if any, of the following factors on nutritional health; a pronounced dry season, failure of the main cash crop, failure of the food crops, and the relative acreage of individual food crops, e.g., millet, sweet potatoes, cassava.

391. If, however, a survey were concerned with an urban population or with labour working on estates, agriculture would naturally not play such a large part. The Research Sub-Committee considered that surveys both of urban populations and of mine and estate labour would often yield most valuable results. Again, a large part of the urban populations of the Colonial Empire consists of peoples who have migrated recently from country districts. In such cases, interesting comparisons could often be made between the state of nutrition of the townsman and that of the rural community from which he came.



392. Whatever the variations, however, in the method of approach to be adopted, all surveys of this kind should have two sides. They should seek as their first object to throw fresh light on the actual composition of dietaries. At the same time attempts should also be made to establish a significant correlation between the character of the diet and the physique and health of the peoples studied. In this way it may well prove possible to obtain more than a mere record of the facts to be interpreted in the light of existing knowledge. Field surveys, if conducted on the right lines, should enable valuable contributions to be made to the study of the etiology of certain types of disease and of the effects of dietetic abnormalities which could not be obtained by research work in this country.

393. Surveys should also provide much information of value for other purposes besides the improvement of nutrition. For instance, they may contribute to the study of population trends and of such questions as the sociological effect of the prolonged absence of male members of the community (which occurs, for instance, in some parts of Africa, where labour is recruited for work at a distance). Without unduly adding to the cost of surveys it should often be possible to include in their scope investigation of some special aspect of the life of the community which would not otherwise be covered. In this way surveys may be expected to furnish information which will be of great interest and value to all concerned with the welfare of the people in question.\*

394. The general conclusion of the Sub-Committee was that the work of field surveys could only be satisfactorily carried out if steps were taken to secure a proper uniformity both in the methods to be adopted and in the standards to be applied. The lack of such uniformity tends to impair the value of much of the information which we possess at present on nutritional conditions not only in colonial territories but in European countries also. From all parts of the Colonial Empire come reports of a wide variety of conditions of malnutrition and even of manifest disease which are ascribed to some deficiency factor. But in the absence of uniform standards and of much fuller scientific evidence than is at present available many of the conclusions formed are little more than intelligent conjectures. If further field surveys were now to be undertaken in colonial territories the Sub-Committee regarded it as essential that there should be some means of co-ordinating the methods adopted by the workers in the field and of securing the application of uniform

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\* It is important that, in order to supply a basis of comparison, surveys should contain data regarding standards of height, weight, etc., for all sections of the community studied. Without such standards it will be impossible to judge in a few years' time whether physique has altered as a result of the improved dietaries which it may be hoped will be introduced.



standards. It is equally important that those engaged in the work of survey should be kept in touch with the latest findings of experimental research, since these may suggest new conditions of disease and new syndromes, which should be studied in the field. Research again may throw fresh and unexpected light on the precise nature of the causative dietetic error responsible for some well-known condition. An example may be found in the recent experiments carried out by two groups of workers in the United States and this country on the value of nicotinic acid as a pellagra-preventive factor. In all these matters it is essential to provide a firm scientific foundation on which the work of surveys in the field can be built up.

395. In order to make provision for this need the Research Sub-Committee considered that it would be of great value if a small whole-time staff could be provided which would act as a scientific nucleus for the purpose of co-ordinating the survey work to be carried out in the field. No more satisfactory method of securing such a staff could be imagined than its association with the Medical Research Council, a body which in recent years has been linked with some of the most important developments in the science of nutrition and is, moreover, the Government organisation officially responsible for research in medical science. The Research Sub-Committee believed that the object in view would best be met if the Council would be willing to appoint a small staff of, say, three persons for a period of five years in the first instance, whose duty would be to undertake the scientific co-ordination of a series of field surveys of diet in relation to health and physique in the Colonial territories. They recommended accordingly that the Secretary of State for the Colonies should inform the Medical Research Council that he would welcome the appointment of such a staff for this purpose and would be prepared to arrange for an application to be made for a grant from the Colonial Development Fund to meet the charges which would be incurred by the investigators for travelling, subsistence and other expenses in the course of their duties. They estimated that the amount required would be of the order of £1,500 a year for five years.

396. The Sub-Committee went on to discuss the means by which surveys should be carried out and concluded that these need not be of an elaborate character though some assistance from external sources would doubtless be necessary in each territory.

397. They also recommended that in each territory there should be at least one officer specially charged to interest himself in problems of human nutrition. He need not always be an officer possessing full medical qualifications. The larger territories may find it possible to appoint one or more officers who



are able to devote their whole time to the subject. For other territories what seems to be required is that there should be one officer—possibly the Secretary of the Nutrition Committee where such a Committee has been set up—who, without in every case devoting more than a part of his time to the subject, should make it his business to keep in touch with developments in nutritional knowledge both in the territory itself and in the world at large.

398. Wherever it is decided to undertake a survey in a particular Dependency the officer referred to above should be responsible for the preliminary organisation, and should, if possible, himself take part in the work. It should not be necessary for special officers recruited from outside the territory to conduct the survey. Given the general direction of the central organisation to be appointed by the Medical Research Council, and if necessary the skilled assistance of one member of its staff, officers seconded from the local service should be able to carry out the survey efficiently. Any lack of technical experience which they may have would be more than counterbalanced by their knowledge of local conditions. In some territories however, the assistance of a trained anthropologist may be desirable and in the case of the African territories, the Sub-Committee hoped that the International Institute of African Languages and Cultures would be prepared to co-operate to the best of their ability.

399. For each survey one Medical Officer, one Agricultural Officer and possibly one Veterinary Officer would be required as well as subordinate staff. It might also be found desirable that an Administrative Officer should take part. In any event, the close co-operation of the Administrative Officer of the district would certainly be needed. The richer territories should be able to afford to second the officers required for the necessary period without assistance. Some territories, however, will not be able to meet the cost from local resources. The Sub-Committee considered that it would be very desirable that funds should be available to enable assistance to be given in such cases, and they suggested that application might appropriately be made for assistance from the Colonial Development Fund.

400. Assistance might also in certain cases be desirable in order to provide facilities for the analysis of samples of local foodstuffs collected in the course of the surveys. It should be possible to carry out the simpler forms of chemical analysis in any well equipped laboratory. A certain amount of work would be involved, however, for which extra staff might be required. Further, biological analysis (vitamin estimation) is still a matter requiring considerable laboratory resources. Where biological analysis is necessary, samples may have to be sent to this country. The Sub-Committee hoped, however, that



it would in the course of time become possible for such analysis to be carried out in one principal laboratory within each main region of the Colonial Empire. Thus in Malaya ample facilities are already available. In East Africa a similar part might be played by the medical laboratory in Nairobi, while in the case of the more southern territories the Institute of Medical Research, Johannesburg might be invited to co-operate. In West Africa the necessary facilities could be made available at the laboratories of the Medical Department in Lagos or Accra. In the West Indies the work could perhaps be undertaken in Trinidad. Any work necessary in the Western Pacific might perhaps be done in Fiji itself or, failing that, assistance might be sought from laboratories in Australia.

401. The Sub-Committee suggested that the Colonial Development Fund might reasonably be asked to provide the funds which would be required to give effect to the proposals for dietary surveys in the field outlined above. The total sum involved would not be large. They recommended accordingly that the Secretary of State for the Colonies should arrange for an application to be submitted for assistance for these purposes from the Colonial Development Fund on the scale indicated.

402. These recommendations put forward by our Research Sub-Committee appeared to us to be well conceived and we accordingly submitted their report to the Economic Advisory Council for transmission to the Secretary of State for the Colonies. In accordance with the conclusions of their report the Colonial Development Advisory Committee recommended that a sum of £24,000 (which would, it is hoped, be increased if necessary) should be earmarked as a token figure from the Colonial Development Fund for the purpose of providing over the next five years assistance to Colonial Governments to enable them to carry out surveys on these lines. The Medical Research Council have also taken action on the lines suggested in the Sub-Committee's report, and have appointed a central staff to undertake the scientific co-ordination of nutrition surveys in colonial territories. Dr. B. S. Platt, M.B., Ch.B., M.Sc., Ph.D., who has had experience of nutritional survey work in China, has been appointed to be the senior member of the new organisation. In addition to the sum of £24,000 referred to above to be set aside from the Colonial Development Fund, the Fund will defray the cost of the travelling, subsistence and incidental expenses to be incurred by the staff for a period of five years.

403. With the assistance of the organisation thus created it is hoped to arrange for a series of surveys throughout the Colonial Empire. Proposals are in train for surveys in several territories, and the first survey is already in progress in Nyasaland. In view of the fact that it is the first of a series and that



the experience gained will largely determine the lines which future surveys should follow, special attention has been given to the organisation and co-ordination of the work. Dr. Platt himself will have spent the greater part of a year in Nyasaland. In addition to himself and his assistant the staff includes a nutritional investigator, an anthropologist provided through the assistance of the International Institute of African Languages and Cultures, a medical officer and an agricultural officer seconded from the service of the Nyasaland Government, and an economic botanist. Simultaneously a survey is being made of the fishery resources of Lake Nyasa and the other waters of the Protectorate by Miss C. K. Ricardo, D.Sc., with the assistance of Miss E. Trewavas whose services have been lent by the British Museum (Natural History). Miss Ricardo and Miss Trewavas will have the help of a local administrative officer. They are working in close touch with the nutritional survey party and are under the general guidance of Dr. Platt. Dr. Platt is also able to draw where necessary on the services of technical officers of the Nyasaland Government in such matters as land surveys and analysis of samples.

404. The investigation is divided into four sections as follows:—

(a) *An economic and agricultural survey.*—This study is most important and the fullest data should be obtained from it. The study includes matters relating to land utilisation (climate, soil composition, soil erosion, systems of cultivation employed, use of manures, irrigation, methods of harvesting and storing) and amounts of the various crops produced (per agricultural unit with information as to proportion of “cash” and “consumer” crops, and distribution in relation to consumer). Other resources are also being studied such as fisheries, livestock, etc. Data will also be obtained on the systems of land tenure, the organisation of labour and tribal customs in relation to agricultural and economic matters. Accurate botanical identification of foodstuffs is essential.

(b) *A dietary survey.*—The amounts of food eaten by the members of typical households in the areas selected will be measured. Arrangements have been made for the analysis of native foodstuffs of unknown composition. Observations are to be recorded on the methods of preparation of foodstuffs for consumption (methods of milling and grinding, amounts of and utilisation of waste products, recipes for “relishes” or “side-dishes,” methods of cooking, etc.)

(c) *Physical and clinical survey.*—A physical and clinical examination is to be made of the natives living in the areas surveyed as in (a) and (b) above. Records will be made of simple physical measurements, of a clinical examination of a general



nature and of evidence of disease with special attention to defects of nutrition and to the sequelae of parasitic infestations. Vital statistics are to be collected in the selected areas and existing statistics examined. Particular consideration is being given to the diets of pregnant and lactating women and to the methods of feeding infants, weanlings and children. An investigation of the factors concerned in infant mortality is being carried out. Observations on native medical lore are also to be recorded.

(d) *Anthropological and social survey*.—A general study of the social and economic life of the native is to be made in the various areas selected. This will, in some of its aspects, be concerned with matters already mentioned in the preceding paragraphs. It will include a study of customs in relation to the production, preparation and eating of foods; land tenure, organisation of labour; distribution, sale and exchange; and incentives to work under modern conditions. Special attention will be paid to the effects on village life of emigration of adult males for labour outside the area.\*

405. We look forward to the achievement of valuable results by means of the survey which as described above is being carried out in Nyasaland. In the course of his visit to East Africa, Dr. Platt has taken the opportunity of conferring with the other East African Governments and of discussing with them plans for the initiation of nutrition surveys in their territories. It is hoped that it will also be possible shortly to organise surveys in other parts of the Colonial Empire such as the West Indies and West Africa. There can be little doubt that the knowledge so gained will be of the greatest assistance in enabling Governments to formulate measures for the improvement of the nutrition and well-being of the peoples of the Colonial Empire.

406. We have emphasised in this section the need for the co-ordination of field research on nutritional matters and we have described proposals for surveys of a rather elaborate type carried out under the aegis of a central organisation. We are

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\* The statistical aspect of these surveys will clearly be one of much importance. One major point of method is worth mentioning here. When quantitative food data has been collected it is not uncommon to find that mean values are given for a group of individuals or for a mean daily intake of a single individual for whom values have been ascertained over a period of time. There are, however, certain disadvantages in the statement of data in this form. In the case of a group of persons there is a risk that considerable differences between individuals may be neglected. In the case of a single individual important seasonal fluctuations of intake may be obscured by this method of presentation. Where we have to deal with the varying individuals who compose family groups the criticism may be met to some extent by expressing the data in terms of "adult male units" using the table of co-efficients given in Chapter III, paragraph 18.



far, however, from wishing to suggest that no research work other than the surveys which this central organisation can superintend should be undertaken in the Colonial Empire. There are plenty of opportunities for work on particular problems which arise in individual territories, and it would be a great mistake not to make use for this purpose of the enthusiasm and experience of officers who are already available on the spot. The central organisation will mostly be concerned with the first of the three types of nutritional survey work which we set out in paragraph 380 above: that is with more or less elaborate field surveys. Besides this there is plenty of room for studies on the relation between diet and disease carried out where groups of people are provided with their food by Government or other responsible body, and for observations on specific deficiency disease conditions made by medical officers in the course of their day to day work. In carrying out such work we hope that the officers concerned will keep in touch with the central organisation whose advice will be available on any points of special difficulty.

407. When Governments or other authorities are entirely responsible for the feeding of a group of people a most valuable means is provided of testing out suggestions for dietary improvements, for control of the experiment is relatively easy. Control is less easy where only part of the food consumed is provided, as where children attending day schools are given supplementary meals; but even in such cases it is possible to obtain valuable data from observing, for instance, the results of specific additions to the diet. In fact, a good deal has already been done, not only by Governments but by other authorities and by private companies, such as mining companies, in observing the effect of particular diets on health.

408. Cost will be an important factor in all such diets, both because there is a limit to what the authority providing the food can afford and also because it is desirable that the meals so provided for the individual should be of a scale which he himself is able to copy in his own home. It is important, therefore, that the food should be of a kind which they themselves will be able to obtain in their own homes.

409. We think it would be well that all diets provided for bulk feeding should be reviewed at regular intervals with the object of providing, with foods which would be available to the people concerned in ordinary life, the maximum nutritive value at the minimum cost, and that the health authorities should as occasion arises vary diets, so as to test out under proper conditions of control the benefits derived from specific alterations in it.

410. The time should be past when deficiency diseases occur in public institutions. Unfortunately, however, they are not alto-



gether unknown, and in other cases the diets given at present are not sufficient for full health. For various reasons it may well be impossible to provide anything like an optimum diet—it may be too expensive, or the necessary foodstuffs may not be available, or in the case of prisoners the provision of a diet too much above that which they enjoy in their own homes might make imprisonment too attractive, and so forth—but there can be no excuse for the continuance of deficiency diseases, and if such are found to exist it follows automatically that the diet is in need of alteration.

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## CHAPTER XV.

## THE NEED FOR CO-OPERATION BETWEEN GOVERNMENT DEPARTMENTS AND FOR THE INTERCHANGE OF INFORMATION.

411. Our discussion of the problem of nutrition, including both its influence upon the welfare of the people and the measures which are needed for its solution, will have shown how many-sided are the issues which it raises. Few other problems are indeed in our view more far-reaching in their repercussions upon almost every aspect of the life of the community. As a scientific problem it is true it has originated in the striking discoveries made by medical investigators in recent times. But when we attempt to measure its practical consequences and to devise remedies, it becomes evident that the solution is bound up with the much wider need for securing a general advance in the standard of living of Colonial peoples and for the spread of knowledge which will enable them to make the best use of their existing resources. Economic and educational progress of this kind cannot be achieved at a single stride. There are, it is true, individual measures which can and should be taken at once which will have a beneficial effect in certain directions; a number of these have been indicated earlier in this report. We look forward also to the achievement of valuable progress as a result of the nutrition surveys, the organization of which is described in the preceding chapter. But for a general and substantial improvement we must depend upon the steady and concerted efforts over a period of years of many government departments and voluntary agencies.

412. The primary responsibility necessarily rests with the Medical and Health Departments. It is by the Medical and Health Officers that the effects of dietary deficiencies will be most immediately observed and it is to them again that Governments naturally look for advice regarding the short-comings of the existing dietary and the directions in which improvement is necessary. Moreover as primarily responsible for the maternity and infant welfare services, they are entrusted with a task of vital importance in the supervision of the diet of nursing mothers and infants.

413. But to make good defects of nutrition it is evident that the activities of other departments must be brought into play. In the predominantly rural conditions of the Colonial Empire it is primarily through the efforts of the Agricultural Departments working in conjunction with the Veterinary Departments that



changes and adjustments in the consumption of foodstuffs must be made.

414. At the same time, as we have endeavoured to show, defects in the composition of the dietary are due in no small part to a general lack of knowledge on the part of the people regarding their dietary needs and the best way of meeting them. Much can be done, therefore, by the Department of Education in contributing to an improvement in nutritional conditions. Apart from direct measures such as the provision of milk and meals for school children, there are, as we have seen, three principal directions in which the educational authorities may bring their influence to bear. They will be responsible in the first place for raising the general level of the intelligence of the people so that the work of the Health and Agricultural Departments may be understood, appreciated, and intelligently applied. Secondly they should see that elementary instruction is given in the schools in the essentials of agriculture, food production and supply, domestic science, personal hygiene, and child welfare. Finally they should take a direct part, working in co-operation with the Agricultural, the Veterinary and the Health Departments under the general supervision of the Administration, in an endeavour to educate the adult mass of the people in the principles of better nutrition.

415. The efforts of the more specialized departments are unlikely to achieve their full effect, unless they receive the support and co-operation of the Administrative Service. It is of the highest importance that Administrative Officers should be alive to the importance of the question of nutrition and should be on the watch for opportunities of promoting better conditions. The central organs of Government also have a large part to play. It is they who finally determine agricultural and health and education policy and allocate funds between the departments. It is for them also to bear in mind the nutritional factor in arriving at decisions on tariff policy.

416. It is not enough, however, to emphasize the individual responsibilities of the various Government Departments. Of equal importance is the need for securing co-ordination between their activities. Each Government must undertake the task of maintaining the balance between progress in all departments. Such a balance implies that the work of one department should not lag behind that of the rest. The efforts of the educational authorities cannot be effective if the children in the schools are weakened and their attention blunted by the effects of malnutrition and disease. Medical services must inevitably be hampered in their task of raising the standard of health if the people undergo privation and hardship because their cattle die through lack of pasture and because the fertility of the soil is impaired through primitive and faulty methods of agriculture. Yet



neither the Health nor the Agricultural Department can make headway if the people are too ignorant or indifferent to be able to understand the importance of sound methods of agriculture, of greater cleanliness and of better housing. The problem therefore is in a sense a vicious circle which can only be broken by the united efforts of every department of government.

417. It was with the object of securing co-ordination of this kind that the Secretary of State in the circular despatch which he addressed to Colonial Governments in April, 1936, suggested that in each territory there should be established a nutrition committee composed of representatives of each of the departments concerned. In most territories a committee of this kind has now been constituted. In certain instances, however, the need has been sufficiently met by an extension of the functions of an existing body, e.g. in Nyasaland the Native Welfare Committee, in Uganda the Agricultural Survey Committee. These local nutrition committees should be capable of exercising an important influence upon the success of Governments in dealing with this problem. In most cases they have already discharged a useful task by the preparation of the surveys of the present position which are summarized in Part II of this report. We hope that every effort will be made to ensure that they continue as active bodies and that full use is made of their services. We are strongly of the opinion that the co-ordination of the services on which an effective nutrition policy depends can only be secured if there exists some such body functioning as a permanent and essential part of the administration of every territory, even the smallest. Indeed we feel that the advantages of a central co-ordinating committee of this nature will not be confined to nutrition but will apply equally to other welfare activities.

418. We consider also that there may often be room for similar co-ordinating Welfare Committees in each province, district, or town, and even in each village. As we have emphasised in paragraph 338 above local Welfare Committees may do a great deal of most valuable work. A further means which may be adopted to secure that attention is adequately focused on the many different aspects of the nutrition problem is that in each territory a single officer (not necessarily a whole-time officer) should be entrusted with the responsibility for keeping his government informed in regard to developments in this field. Our Research Sub-Committee put forward a proposal on these lines to which we have already referred in the previous chapter.

419. In addition to co-operation within the limits of each territory there is also much to be gained from interchange of information within a wider sphere. The conditions of life in the Colonial Empire differ so greatly from territory to territory that a close parallelism in the problems which arise is not to be



expected except perhaps in the case of neighbouring territories. Nevertheless nothing but good can come from a wide dissemination throughout the Colonial Empire of all the knowledge and experience available on this subject from whatever quarter. It is with this object that we have arranged for the preparation of the comprehensive summary of information which appears as Part II of our report. But we wish to emphasize in addition the importance of exploiting fully all the existing channels for the dissemination and interchange of information. In the sphere of international co-operation the Health Organisation of the League of Nations is doing most valuable work in promoting the investigation of the problem of nutrition. On the more purely scientific side also valuable assistance can be given to scientific workers by organisations which help to keep them informed of the progress of research throughout the world. For this reason we attach great importance to the building-up of an adequate system for giving publicity to the results of research, including both information of a more technical kind, such as is furnished through the medium of abstracting journals, and also broader statements of the facts of nutrition addressed to wider audiences. We consider that an important contribution to such a system is provided by the work of collecting and disseminating information, more particularly amongst scientific workers, at present carried on by organisations such as the Bureau of Hygiene and Tropical Diseases and the Imperial Bureau of Animal Nutrition, Aberdeen. We may mention the valuable series of technical communications issued by the Imperial Bureau, and also the extremely important publication "Nutrition Abstracts and Reviews," issued in co-operation with the Reid Library and the Medical Research Council. We hope that the Executive Council of the Imperial Agricultural Bureaux will be prepared to continue and expand the existing functions of the Imperial Bureau of Animal Nutrition in this direction.

420. Finally we may add a word as to the future. It is only comparatively recently that governments have begun to appreciate the full importance of the nutrition problem. The last few years however have been years of great activity, and the place of nutrition as one of the main factors affecting health and well-being has been increasingly recognised. We hope that this activity will be continued and that the question of nutrition will not be allowed, for any reason, to fall into the background. We are convinced that as time passes its importance will become more and more evident as the progress of science reveals new directions in which hitherto unsuspected consequences of dietary errors are traceable. The great need is that the growth of such knowledge should be reflected in Government policy, particularly in regard to agriculture. With the new measures which are now being taken to stimulate investigation of every aspect of the problem, we hope and believe that this will prove to be the case.

## CHAPTER XVI.

## SUMMARY OF CONCLUSIONS.

421. We summarise our principal conclusions as follows:—

*IMPORTANCE OF THE PROBLEM.*

1. The material we have had to handle is extraordinarily diverse covering forty-eight different territories with a population of rather over fifty-five millions, divided into countless groups having the most different food habits and customs that it is possible to imagine. It is because of this diversity that much remains to be added to our knowledge before we can lay claim to a complete understanding of the problem. At the same time the variety of the material before us adds to the opportunities for a scientific study of the inter-play of race and environment. The science of nutrition is still young and little is known of conditions in tropical countries. Of one conclusion, however, we have no doubt and that is the great importance of the subject. We are confident that improved nutrition will bring very great benefit to the Colonial Empire. At the present time the effects of malnutrition are seen not only in definite disease but also in general ill health and lowered resistance to infection, inefficiency of labour in industry and agriculture, maternal and infantile mortality and a general lack of well being. In particular there can be no reasonable doubt that wrong feeding is one of the principal causes of the very high infantile mortality which prevails in most colonial territories. (Paragraphs 1-11.)

2. One of the most striking features of our inquiry has been the almost complete absence of milk and indeed of all animal products from most tropical diets. (Paragraphs 12 and 13.)

3. Throughout the greater part of the Colonial Empire the fundamental cause of malnutrition is the low standard of living of many of its inhabitants. Ignorance is a very important factor also. (Paragraph 14.)

*PRINCIPLES OF CORRECT NUTRITION.**Food requirements of the body.*

4. In order to maintain a state of good nutrition the food supply must be adequate both in quantity and quality. Diet must be sufficient in amount to satisfy the energy demands of



the body, assessed in Calories. These are in the main dictated by the type and amount of muscular work carried out and by other factors such as the age, sex and size of the individual. Climate does not apparently exert any very marked influence. In addition to energy-yielding foodstuffs there is a further class of foodstuffs containing materials which though yielding no energy are essential for all metabolic processes, namely water, mineral salts and vitamins. (Paragraphs 15-19.)

5. The protein component of the diet holds a unique position as the sole source of the essential nitrogen, and it may be said that Calories derived from protein should form some ten per cent. of the total calories ingested. The protein needs of the growing organism per kilo body weight are greater than those of the adult. Certain proteins referred to as first class proteins, and derived in the main from animal sources, are of special value. A mixture of proteins enhances their biological value through the supplementary action which takes place. It may be taken as a guiding principle that especially in the diet of the young there should if possible be included a certain proportion of protein of animal origin, such as that contained in milk. (Paragraphs 20-23.)

6. Fat is a valuable store of energy, though that energy is not so readily available as that derived from carbohydrates. It is usually assumed that the amount of fat required in the tropics is smaller than in temperate countries. Fat also contains certain indispensable vitamins, in particular vitamins A and D. (Paragraph 24.)

7. Carbohydrates, or starchy foods, are abundant and cheap sources of energy. (Paragraph 25.)

8. Of non-energy yielding substances a plentiful supply of water is essential, as about seventy per cent. of the body weight is water. The various mineral salts play an equally essential role as they participate in probably all the tissue activities. Some five or six vitamins have been definitely identified, and these play an essential, but as yet not definitely determined, role in the normal metabolic processes. Vitamin A is important for health and growth and apparently for the normal functioning of the epithelial cells. Vitamin B1 is the anti-neuritic or anti-beriberi vitamin. The vitamin B2 complex includes the anti-pellagra or P-P. vitamin. Vitamin C is the vitamin the lack of which is the causal factor in scurvy. Vitamin D (which may be a complex) is intimately related to the utilisation of calcium and phosphorus in the body and hence to the disease rickets. Vitamin E seems to play some part in the control of the reproductive processes. (Paragraphs 26-35.)



*The Special Requirements of Certain Classes.*

9. At certain periods of life—during pregnancy, lactation, infancy and childhood—an extra physiological strain is imposed upon the body and certain additions to or departures from the normal diet are needed. Under average conditions it is the mother rather than the foetus which suffers during pregnancy in the event of dietary insufficiency. The chief additional needs during pregnancy are for minerals and vitamins which should be supplied by giving as much as possible of the protective foods such as milk, green leafy vegetables, fresh fruit, potatoes if available, beans and bean products, etc. The demands made during lactation are much greater and an increased supply of protein is required as part of a good mixed diet rich in vitamins and minerals. (Paragraphs 36-42.)

10. Complete breast feeding of the infant is of very great importance and while the baby is so fed the need for supplementary dietetic substances is largely diminished. Certain additions may nevertheless be desirable. In the absence of breast feeding artificial feeding for the infant must be carefully thought out and in such cases the inclusion of the different specific protective substances becomes of much greater importance. (Paragraphs 43-45.)

11. The nutritionally important period does not end when the child ceases to be an infant. The next few years also are of great importance. The child is more liable to attacks of infective and possibly debilitating disease and it is therefore highly important that the diet should be both quantitatively and qualitatively adequate.

*Other Factors affecting Correct Nutrition.*

12. Many factors affect the relationship between the food and health. For example the chemical composition of a foodstuff as actually consumed is by no means constant but depends upon the soil in which it is grown, the methods adopted for manuring, harvesting and storing, for marketing, processing and cooking. The power of the individual to benefit from the food he eats is affected by many factors such as the mental state and by environmental conditions, such as faulty hygiene, high humidity, overcrowding, noise and vermin. Pathological conditions may also interfere with the absorption and utilisation of the food consumed. (Paragraphs 46-49.)

13. Nutritional requirements may, it seems, vary somewhat in accordance with race and climate. Other factors which must be studied in assessing the value of a diet are the interaction of various foodstuffs upon one another and the possible action of toxic substances in food. An important but often overlooked criterion for the drawing-up of dietaries is that the food



prescribed, its cooking and its serving should conform so far as possible to the dietary habits of those to be fed. (Paragraphs 50-54.)

### *GENERAL CHARACTER OF COLONIAL DIETARIES.*

14. The dietaries in colonial territories are, with some exceptions, predominantly vegetarian, and relatively small quantities of animal products are consumed. Judged by western standards, an unusually high proportion of the energy value of the diet is derived from carbohydrates. The amount of fat in the diets is usually low. (Paragraphs 55-59.)

15. One of the most striking facts which emerges from our survey is the extent to which colonial peoples are dependent on a single crop for their main supply of food. With few exceptions, almost no milk is consumed, or the amounts are so low as to be of little account from the nutritional standpoint. Fish is perhaps the one animal food which is, or could be, most often included in colonial diets. (Paragraphs 60-62.)

16. As a result of the absence of animal products colonial diets are low in proteins derived from animal sources. There is also general deficiency of fat, and of green leafy vegetables, and fruits. Calcium and phosphorus are also deficient in some colonial diets, and the intake of iron and sodium is inadequate. In many territories there is at present a scarcity of water supplies. The general character of colonial diets suggests that there are deficiencies of the various vitamins. (Paragraphs 63-71.)

17. To sum up, few of the constituents considered necessary in Europe for a nutritionally adequate diet are generally available in sufficient quantities in the Colonial Empire. Diets are frequently insufficient in quantity and still more frequently insufficient in quality. Judged by European standards they lack variety and protective value. (Paragraphs 72-73.)

### *EFFECTS OF MALNUTRITION IN THE COLONIAL EMPIRE.*

18. Food deficiencies may cause well-recognised deficiency diseases, and lead also to general ill-health, lowered resistance, and impaired efficiency and well-being. Amongst definite deficiency diseases those caused by lack of vitamin A are perhaps the most common in the Colonial Empire, and there are reports from a wide selection of territories of affections of the eye, changes in the skin, and other symptoms which may be attributed to a deficiency of this vitamin. Beri-beri, known to be caused by a deficiency of vitamin B1, occurs with frequency in rice-eating countries and is found in various parts of the Colonial Empire. Cases of some degree of deficiency of this



vitamin are probably widely prevalent where the full disease has not been recognised. Pellagra, due to the absence of another member of the B group of vitamins, is reported fairly frequently. Scurvy, caused by absence of vitamin C, is reported only very occasionally in its classical form, chiefly from those few territories in which there is a recurring famine period. Diseases due to the absence of vitamin D are not very often reported. There are reports of the absence of proper bone formation which point to inadequate supplies of calcium and phosphorus. (Paragraphs 74-83.)

19. Apart from these well-recognised disorders there are reports of a number of diseases which are possibly of dietetic origin, but which have not yet been positively identified. These include chalchaleh in Somaliland, chiufa and onyalai in Northern Rhodesia, decoque in the Seychelles, kwashiokor in the Gold Coast and burning feet and butterfly wing in British Honduras. (Paragraph 84.)

20. There is now a general consensus of belief that there exist with great frequency, especially in the tropics, deficiency states which while not resulting in manifest disease prevent the full enjoyment of health. These states, although less obvious, are more insidious than the clearly-defined deficiency diseases and are a much more important factor in the lives of the people. Moreover, the prevalence of malnutrition aggravates many other diseases. This is particularly the case with ulcers and a number of skin affections, leprosy, tuberculosis and malaria. (Paragraphs 85-87.)

21. We do not doubt that if it were possible (as unfortunately it is not) to remove at one stroke all traces of malnutrition in the Colonial Empire there would be an immense gain in physical health, in mental alertness, and in material welfare. Money spent on improved nutrition should be a sound investment, yielding its dividend in the increased welfare of the community as a whole. (Paragraphs 88 and 89.)

### *THE GENERAL CHARACTER OF THE PROBLEM.*

22. The main causes of malnutrition in the Colonial Empire are, in our view: first, that the standard of living is often too low; secondly, that there exists great ignorance coupled with prejudice both with regard to diet itself and to the use of land. We should add also, as a third main cause, the influence of other diseases which react upon the state of nutrition of the individual. This is particularly true of the various types of parasitic infestations which are widespread amongst the inhabitants of tropical countries. (Paragraphs 90-92.)

23. We have no hesitation in saying that in general the fundamental cause of malnutrition is the low standard of living. In almost every part of the Colonial Empire the income of a very



large proportion of the population is a long way below the minimum required for satisfactory nutrition. Money plays a comparatively small part in the economy of many of the Colonial Dependencies and the measurement of incomes is difficult. In general it is the income of the community as a whole that is too low, and not merely that of the less favoured classes. The resources available are too scanty to provide optimum nourishment and at the same time to supply other essential needs as well as all the services of local authorities and the central Government. (Paragraphs 93-100.)

24. Improved nutrition is largely dependent upon economic development, and this, in the Colonial Empire, means primarily an improvement in agricultural production. The Colonial Empire is at present predominantly rural, and the bulk of the foodstuffs consumed are produced within the territory of consumption. But while the main problem is that of rural communities, the problem of the town dweller where it arises is even more acute. Another factor which is of great importance nutritionally in some dependencies is the rapid increase in population that is at present occurring. (Paragraphs 101-110.)

#### *AGRICULTURE AND NUTRITION: GENERAL CONSIDERATIONS.*

25. In framing agricultural policy the nutritional needs of the community are of the first importance. It is for the health authorities to say what are the main deficiencies of the diet of a particular territory, and for the agricultural authorities to consider how those deficiencies may best be met. Close co-operation between the two Departments is therefore necessary. Naturally the nutritional factor cannot alone determine agricultural policy. The aim should be the establishment of a balanced agriculture for the production of commodities to be used either for direct consumption by the producer and his family or for sale for consumption elsewhere in the territory or for sale in overseas markets. As regards commodities produced for export, it appears that the colonial producer must continue to expect to see wide variation in his income from money crops. Family production of food to meet family needs is a great safeguard against some of the worst social and economic effects of fluctuations in the income from money crops. This applies especially to the protective foods, which are usually more expensive to buy and hence less attractive than others of less nutritive value, especially where the wages of the purchaser are low in relation to his nutritional needs. (Paragraphs 111-120.)

26. Colonial Governments should endeavour to ensure that as many people as possible should grow a part at least of the foodstuffs that they consume. Where a labourer for wages is



more or less permanently employed on an estate as in the West Indies, Mauritius, parts of East Africa and Malaya, the estate owner should normally provide him with land for a garden and perhaps even require him to make full use of it and in appropriate cases permit or even require the maintenance of animals, and the production of meat or milk products. In some territories it may be necessary to require by law that a certain proportion of estates should be given over to the production of foodstuffs either by the estates themselves or by co-operation with resident labourers. Satisfactory fences should be provided for food gardens and allotments, wherever the prevalence of predial larceny causes difficulties. Where there is a landless class Colonial Governments should do all they can to provide such persons with, at any rate, some land. (Paragraph 121.)

27. The growth of crops of nutritive value, such as fruit, may be hampered by the fact that the local system of land tenure is such that the individual has no inducement to plant crops of a permanent nature. Another factor which sometimes prevents the increased growth of food crops is the prevalence of predial larceny. (Paragraphs 122-124.)

28. In many parts of the Colonial Empire the seasonal fluctuation of diet is a factor of importance, and various remedial measures such as the encouragement of the drying of green foods, the development of better storage facilities and of early maturing or drought resistant varieties of the normal staple, or the planting of special famine reserve crops, may all be of value. It may thus be possible to guard against a pre-harvest shortage of the staple foodstuffs or a shortage of the important protective foods in a fresh state just before the rains begin. (Paragraphs 125-126.)

29. A valuable increase in foodstuffs may be obtained by improving the yield per acre from crops both by the use of better seed and of better methods of husbandry, combined with organic manures or composts. (Paragraphs 127-130.)

## *THE DESIRABLE ADDITIONS TO COLONIAL DIETS.*

### *New crops.*

30. A good working rule for the improvement of colonial dietaries would be to endeavour to increase the quantity of foodstuffs consumed by increasing the variety. The energy yield per acre of different crops is also a factor of great importance. Diversity may be secured by the introduction of additional staple food crops or by the addition of various extras. The supplementary action of different elements of the diet in combination with one another is a consideration to which weight should be given. From the point of view of nutrition, a combination of cereals and legumes is strongly to be recommended.



Amongst legumes, the soya bean and the ground-nut may be mentioned as being worthy of special consideration. Of the extras green leafy vegetables as a source of calcium have a special importance to colonial nutrition. They are, however, liable to lose their food value owing to their perishable nature. Fruits are in many instances of outstanding importance as sources of vitamin C and contain in addition mineral salts and the precursors of vitamin A. Edible fungi and sea-weeds are valuable for their mineral content, and oil seeds of all kinds have an important bearing on the supply of fats. In particular, red palm oil is of outstanding value, provided that its nutritive qualities are not destroyed by bleaching. (Paragraphs 131-152.)

### *Animal Husbandry.*

31. Wherever practicable, great nutritional value may be derived from increasing the consumption of animal products and this will also assist in the maintenance of soil fertility. In many cases it may be easier to provide good class proteins from vegetable rather than from animal sources, but, subject to considerations of cost, increased consumption of animal products is desirable in almost every part of the Colonial Empire. Not only cattle but also tethered milch goats, poultry and sometimes buffaloes, sheep and pigs may be most valuable sources of animal protein. (Paragraphs 153-163.)

### *Milk and milk products.*

32. Fresh whole milk, besides being the most valuable of all foods, may also, unfortunately, be one of the most dangerous, particularly in the conditions of primitive communities. In these circumstances condensed or dried milk of a good market quality, protected from contamination in use, may be preferable if not too expensive. It is possible that local supplies might be preserved by some form of heat treatment. Milk may be turned into butter or ghee, but this process is wasteful unless the valuable skimmed milk which remains is also used. There is room for development in the use of curds in the Colonial Empire. They are less liable to contamination than fresh milk. Cheese and whey are also of great value. Attention should be directed towards the production of those milk products which are suited to the tastes and requirements of the people, and the conditions under which they live. (Paragraphs 164-173.)

33. Wherever possible Colonial Governments should remove all import duties on milk and milk products. Even if admitted duty free, however, milk and milk products may still be too expensive to provide a solution of the problem. Of all the forms of manufactured milk, dried skimmed milk will yield for a given expenditure by far the largest quantity of all the valuable constituents of milk, except fat and its attendant vitamins. It is especially suitable for bulk use, and valuable results



would be obtained by its increased use—e.g. for distribution to schoolchildren. (Paragraphs 174-179.)

### *Fish.*

34. Fish is a most valuable foodstuff, and we regard it as most important that the supplies of fish in and around colonial waters should be developed to the maximum possible extent. We believe that much useful work might be done by some central organization to advise and assist colonial governments on these matters. (Paragraphs 180-183.)

### *Concentrated foodstuffs.*

35. Circumstances may arise in which certain groups, such as school children, hospital patients, or labourers, may benefit from the distribution of highly protective foods in pure and concentrated form, provided that these can be obtained cheaply in large quantities. The use of local "beers" by colonial peoples in moderation undoubtedly has benefits from the nutritional point of view. Vitamin deficiencies might perhaps be avoided in certain territories by the local production of fish liver oil. Mineral elements may also be supplied sometimes in concentrated form. In some territories steps might be taken to ensure that salt imported should contain a minimum percentage of calcium or iodine. (Paragraphs 184-189.)

## *HARVESTING, PRESERVATION, STORAGE, PROCESSING AND COOKING OF FOODS.*

### *Harvesting.*

36. The chemical composition of any crop is obviously very different at early stages of growth and at maturity. Changes also take place during the period of actual ripening. The treatment of the crop in the field may affect nutritive value considerably, especially as regards vitamins, and vitamin C in particular. Perishable vegetables should be consumed, stored or preserved as soon as possible after collection as they quickly lose much of their nutritive value. Similar considerations apply to animal products. Fish in particular is extremely perishable. (Paragraphs 190-193.)

### *Preservation and storage.*

37. Where food is preserved it is important that a method should be adopted which will involve a minimum loss of nutritive value. Steps should be taken to collect information regarding existing practices adopted in the Colonial Empire for the processing and storing of food and the points on which it is felt locally that there is room for improvement. The information thus obtained should be collated for general circulation. A



large number of methods of preservation and storage are available. Of these drying is one of the most common and need not affect the nutritive value of a foodstuff except in regard to vitamin content. It may, however, affect the time required for cooking. Grain stored in this way must be kept as free as possible from attack by insects and vermin, which at present cause very considerable loss of stored foods in the Colonial Empire. Wherever possible stored products, whether dried or otherwise, should be kept in air-tight containers. Drying may be accompanied by chemical treatment which improves the appearance and keeping qualities of the foodstuff and conserves its nutritive value. Brining is a useful method of preserving fish, meat, and leaves and roots of vegetables. Smoking is a method particularly applicable to fish. The use of acids in souring products and thereby preserving them is of considerable importance. Two other preservatives in general use are saltpetre and sugar. In many parts of the Colonial Empire there are now cool stores in important towns, but for a long time to come they can only have a very limited effect upon the foodstuffs consumed by the poorer classes. Canning is at present employed in the Colonial Empire chiefly in production for export, but a beginning has been made in some parts in canning for local consumption. For a number of reasons, however, canned foodstuffs will never play as important a part in the economy of the Colonial Empire as in some of the western countries. (Paragraphs 194-221.)

38. The available evidence suggests that modern methods of storing foods cause little depreciation in their nutritive value. In fact food of good initial quality that has been stored by the best modern methods is likely to be superior in many respects to similar food which though nominally fresh is in reality stale. (Paragraphs 222 and 223.)

### *Processing.*

39. The processing of foodstuffs may be of great nutritional significance. Methods of processing rice are, for example, of great importance and should receive the careful attention of the authorities in those territories where rice is the staple diet. We have attached as Appendix 6 a valuable memorandum by Dr. Platt on this subject. A high degree of milling also reduces the nutritive value of other grains such as wheat, and in several other cases the normal commercial processes destroy a substantial part of the nutritive value of the article. Processing of foodstuffs may on the other hand give rise to by-products which are of nutritive value such as rice-bran, skimmed milk and the livers of certain fish. Many forms of handling such as grinding, chopping and mincing, add to the value of the product. In some cases, however, methods of preservation,



storage and processing may involve danger of poisoning. (Paragraphs 223-232.)

### *Cooking.*

40. The loss of nutritive factors which takes place in cooking may be important and care is needed in the choice of suitable methods. Due attention, however, must be paid to local preferences for certain flavours and to the methods of cooking adopted to obtain them. In the education of women no subject is likely to be of greater interest or value than a study of cooking methods. (Paragraphs 233-242.)

## *THE PURCHASE OF FOODSTUFFS.*

41. In some territories internal trade, principally in foodstuffs, is important. Its growth will help to diversify the diets of those who live mainly on the foodstuffs which they themselves produce. The development of the internal market will be stimulated by the provision of simple but adequate communications. In those dependencies which rely on the efforts of small producers, there may be need for Government assistance in other directions, such as the establishment of marketing centres and the provision of storage facilities, including warehouses at market centres, cool chambers for the storage of fish and meat, and refrigerated vans on railways. Such measures will be immediately beneficial to Colonial standards of nutrition and will ultimately have far reaching effects upon productivity and the character of the economic organisation. (Paragraphs 243-253.)

42. As regards imports the cardinal consideration must be that the greatest possible quantity of nutritive foodstuffs should be available at the cheapest possible price, though there may be cases in which this principle requires qualification. Imports of nutritive foodstuffs, other than luxuries, should be duty free, unless there is some very good social or economic reason to the contrary. Colonial governments should review their tariffs from this point of view. It may often be that the guarantee of a stable price would be sufficient to induce the growing of a foodstuff which is not grown at present. The number of cases in which the local producer will be assisted by a duty on the marketed article is, we think, considerably smaller than is sometimes supposed. (Paragraphs 254-259.)

## *THE NUTRITION OF PAID LABOURERS.*

43. There is, unfortunately, abundant evidence that in some occupations where it is not customary to provide the employee and his family with food, the wages earned are not sufficient to provide adequate nutrition. To some extent the situation may



be eased by the fact that the wage earner in rural areas grows some of his food himself, and any precise calculation is very difficult. Increased wages may well be justifiable as a purely economic proposition on the ground that they will lead to a more than proportionate increase in efficiency. In some cases, however, an increase in wage rates may not lead to an increase in total earnings. (Paragraphs 260-263.)

44. The importance of the diet of the labourer is now much more generally realised both by governments and by private employers, at any rate in those territories where the labour contract stipulates that the employer should provide food in addition to wages. This is normally the case in East and Central Africa, in the Katanga and on the Rand, where many East Africans are employed. Instances may be quoted of the benefits to health and efficiency of improved dietary scales for labourers. We regard it as almost certain that in Africa, any money spent on bringing the food consumed by the labourer up to an adequate well-balanced ration will be money well spent from the immediate point of view of the employer. There is considerable room for further action both by governments and by employers in this direction. Governments themselves should lead the way and existing legislation should be strengthened. Employers should be required to work out a schedule of diet in consultation with the local health authorities and for their approval. Typical dietaries adequate for proper nutrition should be worked out by the central authorities of each territory for general guidance. Where food is provided by the employer, the clear balance of advantage lies with the giving of food ready cooked. (Paragraphs 264-281.)

45. In areas where the labourer is expected to find his own food, there is still a great deal that the employer can and should do in his own interests to see that the labourers in fact obtain food which is adequate to maintain them in full health and efficiency. Where conditions appear favourable, as, for example, in parts of West Africa, we hope that consideration will be given to the possibility of extending the custom whereby labourers are provided with food by their employers. Assistance may, however, be given in other ways as, for example, by enabling labourers to have their own gardens, or by the provision, either free or at reduced rates, of food of special nutritive value such as meat and fresh vegetables, even where the employer does not undertake to feed his labourers entirely. (Paragraphs 282-293.)

46. Employers may often do most valuable work both for themselves and for the community at small cost by organising maternity and infant welfare work and other such work among the families of their employees. (Paragraphs 294 and 295.)

## THE FACTOR OF IGNORANCE AND THE NEED FOR EDUCATION AND PROPAGANDA.

### *Introductory.*

47. The study of nutrition is such a new science that its conclusions may not always be generally understood amongst those who have an influence on the nutrition of others, such as government officials, members of legislative councils, employers of labour, education authorities and missionaries. Even at the present economic level steps could be taken which would have the effect of improving the standard of nutrition in colonial territories. Some instruction in human nutrition, particularly in the practical application of scientific knowledge in colonial conditions, should be given not only to medical and health officers but also to administrative cadets during their courses at Oxford and Cambridge; to agricultural and veterinary officers during their courses at Cambridge, and the Imperial College of Tropical Agriculture, Trinidad; and to all education officers and teachers in both Government and Mission schools, who attend courses at the Institute of Education or elsewhere. Colonial Governments should also consider ways and means of giving instruction on the subject to staff recruited locally for the Administrative, Health, Education, Agricultural and Veterinary Services. (Paragraphs 296-301.)

48. Instruction in the principles of nutrition will have to overcome innate conservatism, prejudice, religious scruples and taboos. It will in part be dependent on the progress of general education in the Colonial Empire. A highly important role may be played by women in removing ignorance on this subject. In some parts of Africa, according to tribal custom, it is often the women who decide what food crops to grow, who actually grow them, who reap them, store them, cook them and serve them. As a first step, therefore, increased attention should be given to the education of women in these matters, and greater use might be made of women as government welfare agents, such as school mistresses, health workers, midwives, etc. (Paragraphs 302-306.)

### *Welfare propaganda.*

49. Education is required, not only amongst the younger generation but also amongst adults, in the principles of nutrition. The people who must be reached by propaganda will be largely illiterate, and a special technique will be required, calling for understanding, imagination and ingenuity. Various means of propaganda are available. The greater the degree of illiteracy the greater the prestige of the written word, and circulars may



hence prove valuable amongst the illiterate. Reading circles also may usefully be formed with encouragement from the administrative authorities. Amongst the literate, leaflets in the local vernacular might be issued, setting out in simple and non-technical language specimen diets suited to the local conditions. The Press may also exercise a powerful influence, and the publication by the Agricultural and Health departments of regular bulletins for the information of the public has proved a valuable practice in some dependencies. . . An idea which may be worthy of consideration is the forming, under government auspices, of lending libraries of vernacular literature. Suggestions have been made for the preparation of cookery books applicable to local conditions. Direct instruction in regular adult classes may in some territories be a useful form of propaganda, especially if coupled with the use of wireless, the cinema, the magic lantern, or the gramophone. The value of posters for propaganda purposes among the more primitive of colonial peoples is doubtful, and there are various factors which at present limit the extent to which the wireless can be used for welfare purposes among Colonial peoples. In urban areas broadcasting by landlines may have possibilities. Travelling health vans equipped with portable cinema apparatus have proved most useful in various parts of the Colonial Empire. Colonial Governments should consider assisting selected officials who show keenness for the work to obtain portable cinematograph cameras and to receive training in their use. The magic lantern may be of great value. It is cheaper than cinema apparatus and requires less technical knowledge; moreover, the pictures can be accompanied by explanation from a demonstrator. The gramophone with loud speaker also has its advantages. The Colonial Office should obtain information for distribution to Colonial Governments regarding the most suitable type of machine for the making of gramophone records to be used for propaganda purposes. Models, demonstration plots and farms, agricultural stations and stock farms, and shows of all kinds (health weeks and agricultural shows) including competitions with prizes, may all be found valuable means of spreading a knowledge of the principles of nutrition. (Paragraphs 307-336.)

50. An important agency in securing social betterment may be found in village welfare committees, which already exist in several territories. Other local organizations may also be used with profit, and the co-operation of missionary societies would naturally be sought. Local officials have an important part to play, and we regard it as of the greatest importance that as many school teachers as possible should be trained in domestic science and agricultural subjects, and that such subjects should normally form part of the curriculum in the schools themselves. Health visitors are of great service in decreasing infant and maternal mortality, and in improving the nutrition of children generally.



Valuable welfare work may also be done by travelling propaganda units and it is to be hoped that the number of such units may be increased. In general, welfare propaganda will be more effective if a number of departments concentrate their activities upon the same district. Examples of schemes involving action on these lines can be found in various parts of the Colonial Empire, and other governments might find these examples worthy of imitation. Governments should do their best to interest prominent local residents, and perhaps particularly the wives of officials, in local welfare work, especially amongst women. A number of co-operative societies exist in the Colonial Empire but there is room for a far wider use of them. (Paragraphs 337-348.)

51. A number of general principles emerge from our survey of the means and agents of welfare propaganda which should, we suggest, be taken into account by anyone whose duty it is to plan such propaganda. (Paragraph 349.)

#### *The education of the young.*

52. We attach the greatest importance to the teaching of agriculture to pupils in rural areas. The school garden or farm is a necessity to rural education. An alternative is the "home garden" or "project system" whereby the parents of the children are induced to give them a set portion of the family land to cultivate, under the supervision of their teacher. Similarly all children, whether in town or country, should be taught the elements of hygiene, and for girls the teaching of domestic science should be one of the most important parts of the curriculum. For all these purposes the first requisite is better training of teachers in agriculture, health, and domestic science. Colonial Governments and all missionary bodies engaged in education should make it their policy to see that teachers appointed for work in rural areas should have some knowledge of local agriculture, elementary hygiene, and "home building" and that women teachers both in rural areas and elsewhere should be qualified to teach domestic science of a kind applicable to local conditions. It may be necessary to appoint persons specially to undertake the training of teachers in domestic science and health work. (Paragraphs 350-359.)

#### *Meals for school children.*

53. Schemes have been instituted in some territories for the provision of meals to school children. A limiting factor is, of course, the cost involved, but we commend these examples to colonial governments for imitation wherever possible. (Paragraphs 360-362.)



*PRE-NATAL SERVICES AND INFANT WELFARE WORK.*

54. Pregnancy and lactation, infancy and childhood are from a nutritional point of view, of outstanding importance. Malnutrition, mainly resulting from unsuitable feeding, seems to be undoubtedly one of the most important factors in causing high infant mortality in tropical countries, which at present exceeds 200 per 1,000 live births in many parts of the Colonial Empire, and sometimes even exceeds 300 per 1,000. Excellent work is already being done, but we think that colonial governments would find that on any long view increased attention to infant welfare work was one of the most productive forms of expenditure. The assistance of voluntary workers should be invoked wherever possible, and estates or mines should be encouraged to provide infant welfare facilities in those countries where it is customary for the labourer to be accompanied by his family. The first lesson which must be taught is the importance of breast feeding without the addition of other unsuitable food, and instruction in infant welfare should include instruction to mothers as to their own diet during lactation. It is important that instruction should also be given in the proper dietary of children after they are weaned. Ante-natal and infant welfare clinics, health visitors and propaganda on the lines discussed in Conclusions 44-49 above should all play their part. (Paragraphs 363-371.)

55. A very important cause of malnutrition in the West Indies, in some African towns, and in one or two other parts of the Colonial Empire, is the absence in the parents of a sense of responsibility for the welfare of their children. In the West Indies, for instance, a large proportion of the children are the result of casual unions, and this state of affairs constitutes a social problem of the first magnitude. (Paragraphs 372 and 373.)

56. Our primary concern has been with malnutrition as a factor in infant mortality and sickness, but it is obvious that there are also other factors concerned, such as malaria, congenital diseases, hookworm, and other infestation. (Paragraph 374.)

*THE NEED FOR FURTHER KNOWLEDGE.*

57. The nutrition of colonial peoples is a problem of such range and complexity that our knowledge of it is necessarily still imperfect and incomplete. A distinction may be drawn between laboratory research of a more or less elaborate kind, and field surveys of nutrition in relation to health. The facilities available for work of the former character are naturally confined to one or two laboratories in the larger Colonial territories. (Paragraphs 375-379.)

58. Apart from laboratory studies a good deal of work has been carried out in parts of the Colonial Empire in investigating the diet and health of the population. This includes (i) field surveys the purpose of which is to determine what the people eat, and the state of their physique, (ii) studies on the relation between diet and disease carried out where groups of people are provided with food by Government or other responsible bodies as in hospitals, prisons, police and military forces, labour in mines and on estates, etc., (iii) observations on specific deficiency disease conditions encountered by medical officers in the course of their day-to-day work. (Paragraphs 380-386.)

59. The chief need at the present time is not for elaborate laboratory research on such questions as the basal metabolic rates of tropical races. The main need is for field survey work including studies of the diet of both rural and urban peoples. These surveys should provide as complete a knowledge as possible of the elementary facts in regard to the diet, health and physique of the peoples studied. It should be borne in mind that in the large majority of cases agricultural conditions must play an extremely important part in causing abnormalities of diet. (Paragraphs 387-393.)

60. The work of field surveys can only be satisfactorily carried out if steps are taken to secure a proper uniformity both in the methods to be adopted and in the standards to be applied. It is equally important that those engaged in the work of survey should be kept in touch with the latest findings of experimental research. In order to make provision for this need, we considered that it would be of great value if a small whole-time staff could be provided which would act as a scientific nucleus for the purpose of co-ordinating the survey work to be carried out in the field. We accordingly welcome the action of the Medical Research Council who, in accordance with a recommendation submitted by us and with financial assistance from the Colonial Development Fund, have appointed a central staff to undertake the scientific co-ordination of nutrition surveys in colonial territories. Assistance will also be given from the Colonial Development Fund to meet the expenses of these surveys, the first of which is already in progress in Nyasaland. It is hoped that it will be possible also shortly to organise surveys in other parts of the Colonial Empire, and there can be little doubt that the knowledge so gained will be of the greatest assistance to government in formulating measures for the improvement of the nutrition and well-being of the people. (Paragraphs 394-405.)

61. In addition to the surveys of a comparatively elaborate kind, carried out under the aegis of the central organisation, there are many opportunities for work on particular problems arising in individual territories, and especially for studies on



the relation between diet and disease where groups of people are provided with their food by government and other responsible bodies, and also for observations on specific deficiency disease conditions made by medical officers in the course of their day-to-day work. As regards the former, we think that it would be well that all diets provided for bulk feeding in institutions should be reviewed at regular intervals, and that the health authorities should, as occasion arises, vary diets so as to test out, under proper conditions of control, the effects of specific alterations. In particular, if deficiency diseases are found to exist, it follows automatically that the diet is in need of alterations. (Paragraphs 406-410.)

### *THE NEED FOR CO-OPERATION BETWEEN GOVERNMENT DEPARTMENTS AND FOR THE INTERCHANGE OF INFORMATION.*

62. A general and substantial improvement in nutrition in the Colonial Empire must depend upon the steady and concerted efforts over a period of years of many government departments and voluntary agencies. The primary responsibility necessarily rests with the Medical and Health Departments, but it is through the efforts of the Agricultural Department, working in conjunction with the Veterinary Department, that changes and adjustments in the production of foodstuffs must be made. Much can be done also by the Department of Education in contributing to an improvement in nutritional conditions. The efforts of the more specialised departments will not achieve their full effect unless they receive the support and co-operation of the Administration. Of equal importance is the need for securing co-ordination. Local nutrition committees should be capable of exercising an important influence in this direction, and we hope that they will continue as active bodies, and that full use will be made of their services. (Paragraphs 411-418.)

63. In addition to co-operation within the limits of each territory there is also much to be gained from an interchange of information within a wider sphere. We hope that, if funds permit, the Executive Council of the Imperial Agricultural Bureaux will be prepared to continue and expand the existing functions of the Imperial Bureau of Animal Nutrition in this direction. (Paragraph 419.)

64. We hope that the activity displayed by governments in dealing with this problem in recent years will be continued and that the question of nutrition will not be allowed for any reason to fall into the background. We are convinced that its importance will become more and more evident as the progress of

science reveals new directions in which unsuspected consequences of dietary errors are traceable. The great need is that the growth of knowledge should be reflected in Government policy particularly in regard to agriculture. With the new measures which are now being taken to stimulate investigation of every aspect of the problem, we hope and believe that this will prove to be the case. (Paragraph 420.)

(Signed) DE LA WARR, *Chairman.*

E. P. CATHCART.

GERARD L. M. CLAUSON.

PHILIPPA C. ESDAILE.

RAYMOND FIRTH.

N. F. HALL.

J. M. HAMILL.

FRANCIS HEMMING.

E. M. H. LLOYD.

E. MELLANBY.

A. J. R. O'BRIEN.

J. B. ORR.

H. S. SCOTT.

F. A. STOCKDALE.

HANNS VISCHER.

(Signed) D. H. F. RICKETT.

C. G. EASTWOOD.

*Joint Secretaries to the Committee.*

Gwydyr House,  
Whitehall, S.W.1.

12th June, 1939.



## APPENDIX I.

*Circular Despatch from the Secretary of State for the Colonies to the Officers Administering the Governments of the Colonies, Protectorates and Mandated Territories.*

Downing Street,  
18th April, 1936.

SIR,

I have the honour to address you on the important subject of nutrition, its relation to public health and especially the bearing which it should have upon agricultural, veterinary, educational and general policy in the Colonial Empire.

2. The subject of nutrition is one in which there has been a great advance of technical knowledge in the last 30 years and one to which much public attention is now directed. It is probably true to say that it is now regarded as one of the most important aspects of public health work in all countries.

3. Thirty years ago it was generally believed that the dietary requirements of human beings are satisfied so long as they have a large enough quantity of food to eat. It is now known that the adequacy of a dietary depends on the presence of a number of factors, and that with quantitative sufficiency there may be qualitative defects producing the most serious physical consequences. In many European conditions the deficiencies of diet are normally not so much in the "energy-giving" foods as in the "protective" foods containing vitamins and mineral salts. While a man may continue to exist on a diet which is sufficient in the energy-giving foods but deficient in the protective foods, the absence of these latter may render him an easy prey to infectious diseases or may impair all his capacities and his efficiency for any form of activity. Their absence has especially deleterious effects upon children and nursing and pregnant mothers.

4. While this much has been comparatively common knowledge for some years, attention has recently been focused on the matter by reports and inquiries carried out by various organs of the League of Nations and particularly by a report of Drs. Burnet and Aykroyd which was published in the Quarterly Bulletin of the Health Organisation of the League of Nations for June, 1935. Copies of a reprint of this report have already been sent to a number of Colonial Dependencies in a note of the 13th of December last. In the case of those Dependencies to which copies were not so sent, copies will be found enclosed\* in this despatch. This report is, I consider, a most useful survey of the state of present knowledge of the subject, and will be found of interest to those without special technical knowledge as well as to Medical Officers.

5. An aspect of the matter which is attracting much attention at the moment is that of the application of the new knowledge to the economic and agricultural problems of the present day. The whole subject was considered in an interesting debate which took place at the Assembly of the League of Nations in September last. Mr. Bruce, on behalf of the Commonwealth of Australia, spoke in the Assembly of the benefits which would come of "a marriage of health and agriculture." Assuming an affirmative answer to the preliminary question, "Does the evidence show that increased consumption of certain foodstuffs would improve national health?" there were, he said, three main aspects of the problem:—

- (i) Were there any practical means of increasing consumption?
- (ii) Would such an increase in consumption contribute to the improvement of the world's agricultural position? and
- (iii) What would be the effect of such improvement on the general economic situation?

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\* Not reprinted here.



6. In the subsequent discussion there was general agreement that there were considerable possibilities of increased consumption of agricultural products as the result of expenditure and efforts by Government directed towards improved nutrition; and it was agreed that such expenditure and efforts constituted a direct and practical means of attacking the problem of agricultural surpluses and the low prices consequent upon them. At the conclusion of the debate the Assembly adopted a Resolution in which, "having considered the subject of nutrition in relation to public health and the effects of improved nutrition on the consumption of agricultural products," it "urged the Governments to examine the practical means of securing better nutrition"; it requested the Council of the League to set in motion various further inquiries and to arrange for a general report on the whole matter to be submitted to the Session of the Assembly in September next.

7. As the first result of this Resolution a report has been produced by a commission of experts of great authority on the Physiological Bases of Nutrition; copies of this report are enclosed\* in this despatch. It will be seen that the report sets out an agreed estimate of the various constituents of an adequate diet required for persons of European race living in temperate climates. It thus provides not only an objective towards which to aim but also an authoritative standard by which to measure the degree of malnutrition at present existing in temperate countries. Such a standard has in the past been lacking.

8. There is no doubt that the potentialities of improved nutrition in affecting not only public health but also the economic and agricultural problems of the day are great. For instance if in the United Kingdom alone the average consumption of milk a head a week increased from its present low level of  $2\frac{3}{4}$  pints to 4 pints (a figure still well below what medical opinion regards as adequate), not only would the health of the nation be very greatly improved but also it has been estimated that it would be necessary for 800,000 more cows to be kept—with results which would be far-reaching to agriculture not only in this country but in the Dominions and the Argentine and indeed throughout the world (including, incidentally, certain parts of the Colonial Empire). On the public health aspect, there can be little doubt that every part of the Colonial Empire would benefit from an improved nutrition of its peoples. On the economic and agricultural aspect, while I doubt whether the Colonial Empire has at present any substantial contribution to offer, by way of increased consumption, to the solution of world problems (the monetary resources both of its Governments and of its peoples being too slender to enable them to increase more than slowly their purchases from abroad), I do feel that within its own borders increased attention to dietetic needs might well lead to an amelioration of some of its own economic problems. Not only will greater consumption of foodstuffs within each territory, small though it be in terms of world consumption, increase the local market for local food products, but also expenditure on improved nutrition may well be directly remunerative itself, leading as it should to a greater well-being, greater efficiency in production and less waste of human life and effort. I am therefore most anxious that the Colonial Empire should not be behindhand in the attention devoted to this subject. I would invite your co-operation to this end.

9. I am far from wishing to imply that the subject has been neglected in the past in the Colonial Empire. Indeed, much important work has been, and is being, carried out. Measures for the control of beriberi in Malaya were an early example in the dietetic field of the application of scientific knowledge to public health questions on a large scale, and much useful work is being carried out to-day in the Colonial Empire not only in

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\* Not reprinted here. A revised edition has now been published (League of Nations Publications 1936 II B4.).



research but also in the application of scientific knowledge. I would especially mention the valuable work that is being done in Nigeria, the Straits Settlements, and Uganda. I feel, however, first that there must be much knowledge on the subject which is unrecorded or not easily accessible, and secondly that medical knowledge on questions of nutrition may not in some Dependencies be fully reflected in agricultural, veterinary, educational and other aspects of Government policy.

10. In these circumstances, I consider it most desirable that there should be a comprehensive survey of the position in each Dependency. In order that it may conform with suggestions likely to be made as a result of the further studies to be undertaken by the League Organisations, I think it is desirable that the survey should cover:—

(a) A review of the present knowledge of human nutrition in each Dependency.

(b) A review of the further studies and researches on the subject which appear desirable.

(c) A review of the practical measures which have been taken in the past to apply scientific knowledge to the improvement of nutrition.

(d) A review of the further such measures which it appears desirable to take in the future.

(e) A review of the consequences which improvements in nutrition may have upon the economy of the Dependency.

I have to request that you will send me as soon as practicable, a survey on the above lines, in a form suitable if need be for publication.

11. Under heads (a) and (c) a list should be given of any literature which has been published on the subject.

As regards head (b), while the planning of further research must be primarily for the Medical Department, it will not, of course, be overlooked that much information of value has been acquired from studies carried out by Agricultural and Veterinary Departments on animal nutrition. Nor can a research programme be drawn up without regard to (d), the practical measures to be taken in the future to apply scientific knowledge to the improvement of nutrition. This is a matter which concerns many branches of Government, notably the Secretariat, the Administration, and the Education, Agricultural, Veterinary and Medical Departments; and if a proper plan of action is to be laid down and effectively carried through, there must be close co-operation between them all. In some Dependencies I believe that there already exists a Standing Committee including representatives of these Departments, whose duty it is to co-ordinate and inspire the policy of the Government on this important matter. I suggest that the establishment of a similar Committee should be considered in every Dependency as a first step towards the formulation of policy which will be necessary before heads (b) and (d) of the survey can be completed.

12. Progress towards improved nutrition must, of course, be slow, and the policy to be adopted in each Dependency must vary according to the soil and climate and according to the habits and resources of the population. There can be no question of any sudden change of dietary habits and no doubt the populations of the Colonial Empire will be more conservative than those of European countries have proved to be. Nevertheless, the marked change which has taken place in the diets of European nations in the last 50 years shows that there is nothing immutable about dietary habits and that they are determined less by choice and instinct than by the variable factor of economic necessity.

13. Government has to its hand many agencies by which improvements in nutrition can be effected. First and foremost are the activities of the Medical Department itself, and especially its maternity and infant welfare services. It is to-day generally recognised that from the nutritional point of view the pre-natal and immediately post-natal periods are the most

important in the life-span, and that the diet of mother and child during these months may affect fundamentally the child's whole development. The supervision of diet must therefore be one of the most important aspects of all maternity and infant welfare services. I would urge upon all Colonial Governments the desirability of an expansion of these services to the limit that funds permit. It will no doubt be borne in mind that this is a branch of Government activities for which it is often possible to enlist much most valuable voluntary assistance.

14. Apart from the Medical Department, the most obvious agency for effecting improvements in nutrition is the school. In a variety of ways it is possible to instil into the younger generation improved ideas on diet, for instance by lessons in cooking and domestic science and by encouraging the development of school gardens where crops may be grown for consumption by the pupils, thereby not only improving their own health at the time but also initiating them into habits which may be of benefit to them all their lives. I have no doubt that many other means exist suited to each Dependency. I have been particularly interested to hear of proposals for giving milk to schoolchildren in Ceylon and Malta. While action of this nature on any large scale may be impracticable in many Dependencies at present, there can be no doubt of the immense benefit which children derive from an increased supply of milk. Some interesting information on this point is given on pages 82 to 94 of the Burnet-Aykroyd Report. I am arranging for copies of this despatch to be laid before my Advisory Committee on Education in the Colonies with a view to obtaining their recommendations on the subject generally, and in particular on such matters as training of education officers, preparation of text books, &c.

15. The Agricultural and Veterinary Departments have also an important part to play in the subject. In planning the production of the territory the aim should be twofold; on the one hand the provision to the entire population of a food supply of a nature considered adequate by medical science and, on the other, the growth of remunerative export crops. It is one of the main purposes of this despatch to draw attention to the importance of an adequate supply of locally grown foodstuffs and to urge that it should be given first consideration in the formulation of agricultural policy.

16. Much can, I feel, be done by the instruction of those who are in a position themselves to instruct others, for instance all members of Education Departments and all members of the Administration and of Agricultural, Veterinary and Medical Departments. I, therefore, suggest that it might prove useful to issue to all such officers a brief circular explaining the importance of the subject and what should be the aims of Government in regard to it. I have recently seen one such circular issued in Tanganyika and I have read with interest of instructional courses for schoolteachers in Malaya.

17. The nature of the tariff can also have an important effect upon nutrition. Many other considerations, of course, must be given due weight in framing tariff policy, but I consider it of the greatest importance that the tariffs of Colonial Dependencies should be framed in such a way as to encourage as much as possible the consumption of foodstuffs of high nutritive value. This is an aspect which has, I think, received little attention in the past so that often it happens that those articles which are of high nutritive value are among those contributing most highly to customs revenue. It should, of course, always be the policy to exempt from duty so far as practicable articles consumed only by the poorer classes, but I consider it important that this policy should be extended to the greatest degree possible to cover all foodstuffs of high nutritive value by whatever class they are consumed.

18. There are no doubt many other agencies by which Government can influence dietary habits. For instance in Dependencies in which large



scale enterprises exist, e.g., mines and large estates, great opportunities occur (and indeed are already for the most part taken) for the inculcation of improved dietary habits. The individual is in such circumstances normally engaged in an occupation where some change of his habits is inevitable; it is the duty of Government by the laying down of minimum scales of rations and by proper inspection and supervision to ensure that that change shall be in the right direction.

19. These and other possibilities will no doubt be considered by the Committee which I have suggested earlier in this despatch if you decide to adopt that suggestion.

20. In conclusion I would remind you that one of the objects which may be assisted by the Colonial Development Fund is "the promotion of public health in the Colonial Empire." Assistance has already been granted from the Fund for the study of nutrition problems in Malaya and Nigeria. While, of course, I cannot foretell the attitude which the Colonial Development Advisory Committee may take, I need hardly say that I shall be very ready to consider favourably any further proposals that may be put forward, for submission to them, for the grant of assistance towards the improvement of nutrition.

I have, &c.,

J. H. THOMAS.

## APPENDIX 2.

### List of reports on nutrition published locally in the Colonial Empire.

The following is a list of the Reports which have been published in the Colonial Dependencies as a result of the Secretary of State's circular despatch of the 18th of April, 1936. Copies are on sale by the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

|  | s. | d. |
|--|----|----|
| <i>Barbados:</i>   |    |    |
| Report of the Committee appointed to consider and report on the question of nutrition in Barbados ... ..     | 9  |    |
| <i>Bechuanaland:</i>   |    |    |
| Food in Relation to Health and Disease, by M. Gerber, M.D.   | 6  |    |
| <i>British Guiana:</i>   |    |    |
| Report of the Nutrition Committee (Third Legislative Council, Second Session, 1936-37) ... ..                | 2  | 6  |
| <i>British Honduras:</i>   |    |    |
| A Report of the Committee on Nutrition in the Colony of British Honduras ... ..                              | 5  | 0  |
| <i>Ceylon:</i>   |    |    |
| Report on Nutrition in Ceylon, February 1937 (Sessional Paper II—1937) ... ..                                | 4  |    |
| Further Report on Nutrition in Ceylon (December 1937; Sessional Paper XXIX, 1937) ... ..                     | 1  | 1  |
| <i>Dominica:</i>   |    |    |
| Survey of the Position as regards Nutrition in Dominica—1937   | 4  |    |
| <i>Falkland Islands:</i>   |    |    |
| Report on Nutrition and Public Health in the Falkland Islands  | 3  |    |
| <i>Grenada:</i>  |    |    |
| "Nutrition"—Memorandum by Dr. B. Spearman, O.B.E., Senior Medical Officer. (Council Paper No. 5 of 1938) ... | 6  |    |
| <i>Jamaica:</i>  |    |    |
| Report of the Nutrition Committee, 1936-37 ... ..  | 1  | 0  |
| <i>Malta:</i>  |    |    |
| Report of a Committee appointed to inquire and report on the question of Nutrition in Malta and Gozo ... ..  | 4  |    |

|   |   |    |    |
|---|---|----|----|
| <i>Nigeria:</i>   |   | s. | d. |
| Food in Relation to Health ... ..   |   |    | 3  |
| <i>Northern Rhodesia:</i>   |   |    |    |
| A Report of the Committee appointed to make a Survey and present a Review of the present Position of Nutrition in Northern Rhodesia ... ..  | 2 |    | 6  |
| <i>Nyasaland:</i>   |   |    |    |
| Review of the Nutrition of Natives ... ..   | 2 |    | 6  |
| <i>Sierra Leone:</i>  |   |    |    |
| Review of the Present Knowledge of Human Nutrition with remarks of Practical Measures taken by the Medical Department in the past to its improvement in Sierra Leone. Sessional Paper 5/1938 ... .. | 2 |    | 0  |
| <i>Somaliland:</i>  |   |    |    |
| Arrangements are being made for the publication of the report from Somaliland. Copies will be obtainable from the Crown Agents for the Colonies but the price is not yet fixed.                     |   |    |    |
| <i>Tanganyika Territory:</i>  |   |    |    |
| Preliminary Survey of the Position in regard to Nutrition amongst the Natives of Tanganyika Territory ... ..  | 1 |    | 6  |
| <i>Trinidad:</i>  |   |    |    |
| Food in Relation to Health. Issued by the Nutrition Committee, 1937 ... ..  | 1 |    | 3  |
| Report on the Activities of the Nutrition Committee from its inception up to 30th September, 1936. (Council Paper No. 104 of 1936) ... ..   |   |    | 4  |
| <i>Uganda:</i>  |   |    |    |
| Agricultural Survey Committee: Report of the Nutrition Subcommittee ... ..  |   |    | 6  |
| An Investigation into Health and Agriculture in Teso, Uganda—Nutrition Report No. 1—Teso ... ..   | 1 |    | 0  |
| <i>Zanzibar:</i>  |   |    |    |
| Nutritional Review of the Natives of Zanzibar ... ..  | 1 | }  | 6  |
| Nutritional Problems of Zanzibar Protectorate. (Sessional Paper No. 10 of 1937) ... ..  |   |    |    |
|   |   |    |    |
| <i>Note.</i> —The prices given do not include postage.  |   |    |    |

### APPENDIX 3.

#### Note on the nutritive value of imports of preserved milk into the Colonial Empire.

1. The object is to determine what kind of preserved milk when imported into a Colonial Dependency gives the highest nutritive value per £1 spent when consumed in combination with the existing dietary.

2. Unfortunately for a number of reasons an unequivocal answer to this question is impossible. In the first place, the prices of different kinds of milks do not by any means bear the same relation to one another throughout the Colonial Empire. Secondly, full information is not available about prices in any Colonial Dependency. Thirdly, the needs of all Dependencies are not the same. For instance, the people of most territories suffer from a shortage of fats. In such cases the fat content of manufactured milk may be more than usually important, though it will probably be found that there are cheaper ways of making up the deficiency than by the use of milk fat.

3. The different types of preserved milk which have to be considered are:—

Condensed sweetened whole milk.



Condensed unsweetened whole milk (also known as evaporated milk).

Condensed sweetened skimmed milk.

Dried whole milk, manufactured

(a) by the roller process.

(b) by the spray process\*.

Dried skimmed milk, manufactured

(a) by the roller process.

(b) by the spray process.

The bulk of the Colonial imports of tinned milk consists at present of condensed sweetened whole milk. In some territories imports of skimmed milk products are at present prohibited.

4. The following table gives typical figures for the composition of fresh English milk and of various forms of preserved milk. In Great Britain the minimum contents of fat and of total milk solids are laid down by legislation for all three types of condensed milk, so that the figures quoted may be taken as applying to products of a high standard. Although the constituents of products imported into the Colonial Empire may not always coincide with those in the table, the latter will afford a satisfactory guide to the comparative nutritive value of the various forms of preserved milk.

TABLE I.

CONSTITUENTS OF ENGLISH MILK AND OF CERTAIN MILK PRODUCTS.

*Per 100 grammes.*

|  | <i>Protein.</i> | <i>Fat.</i> | <i>Carbo-<br/>hydrate.</i> | <i>Calcium.</i> | <i>Phos-<br/>phorus.</i> | <i>Iron.</i> |
|--|-----------------|-------------|----------------------------|-----------------|--------------------------|--------------|
| Fresh whole milk† ...                                  | 3.3             | 3.6         | 4.8                        | 0.120           | 0.093                    | 0.00024      |
| Fresh skimmed milk†...                                 | 3.4             | 0.3         | 5.0                        | 0.122           | 0.096                    | 0.00025      |
| Condensed sweetened whole milk ...                     | 8.4             | 9.2         | 54.0                       | 0.306           | 0.237                    | 0.00060      |
| Condensed unsweetened whole milk (evaporated milk) ... | 8.4             | 9.2         | 12.3                       | 0.306           | 0.237                    | 0.00060      |
| Condensed sweetened skimmed milk ...                   | 9.7             | 0.5         | 61.0                       | 0.353           | 0.273                    | 0.00070      |
| Dried whole milk ...                                   | 25.8            | 28.2        | 37.5                       | 0.937           | 0.727                    | 0.00187      |
| Dried skimmed milk ...                                 | 35.8            | 1.5         | 52.1                       | 1.302           | 1.009                    | 0.00260      |

† These figures are given per 100 millilitres, which are equivalent to roughly 103 grammes.

5. The price of milk varies so much from territory to territory and from time to time that it is not possible on the basis of Table I above to make any exact calculation, which will be generally applicable, of the quantity of each of the chemical constituents of milk which can be obtained by the expenditure of £1. Table II below may, however, be useful as a general guide, and it should be easy to make an exact calculation locally where full particulars of the prices of various types of milk can be obtained. The prices on which the figures in Table II are based do not correspond with the actual market prices at any spot on any particular

\* Dried whole milk, whether roller or spray, would be liable, in the conditions of most Colonies, to suffer changes owing to oxidation unless packed and stored under special conditions i.e. in a vacuum and under nitrogen, which would be expensive. It cannot therefore be recommended at present. The figures for it are however given in the following tables. Special dried whole milk products—infant foods, etc.—are left out of account, since as normally sold they are expensive foods. If sold direct in bulk, however, they need not be very much more expensive than dried whole milk powder.

TABLE II.  
APPROXIMATE AMOUNTS (IN GRAMMES) OF VARIOUS CONSTITUENTS OBTAINED PER £1 SPENT ON DIFFERENT KINDS  
OF PRESERVED MILK.

| 1.                             | 2.    | 3.<br>Price<br>per cwt. | 4.<br>Fat. | 5.<br>Protein. | 6.<br>Carbo-<br>hydrates. | 7.<br>Calcium. | 8.<br>Phosphorus. | 9.<br>Iron. | 10.<br>Raw milk<br>equivalent<br>(gallons)† |
|--------------------------------|-------|-------------------------|------------|----------------|---------------------------|----------------|-------------------|-------------|---|
|                                |       | s. d.                   |            |                |                           |                |                   |             |   |
| Condensed whole, sweetened ... | Bulk* | 35 0                    | 2,670      | 2,440          | 15,680                    | 89             | 69                | 0·17        | 17  |
| Condensed whole, sweetened ... | 1 lb. | 50 0                    | 1,870      | 1,710          | 10,975                    | 62             | 48                | 0·12        | 12  |
| Condensed whole, unsweetened   | Bulk  | 35 0                    | 2,670      | 2,440          | 3,570                     | 89             | 69                | 0·17        | 17  |
| Condensed whole, unsweetened   | 1 lb. | 50 0                    | 1,870      | 1,710          | 2,500                     | 62             | 48                | 0·12        | 12  |
| Condensed, skimmed, sweetened  | Bulk  | 22 6                    | 225        | 4,380          | 27,550                    | 159            | 123               | 0·32        | 32  |
| Condensed, skimmed, sweetened  | 1 lb. | 30 0                    | 170        | 3,285          | 20,660                    | 120            | 92                | 0·24        | 24  |
| Dried whole, roller ...        | Bulk  | 50 0                    | 5,730      | 5,245          | 7,620                     | 190            | 148               | 0·38        | 38  |
| Dried whole, roller ...        | 1 lb. | 70 0                    | 4,095      | 3,745          | 5,445                     | 136            | 106               | 0·27        | 27  |
| Dried whole, spray ...         | Bulk  | 70 0                    | 4,095      | 3,745          | 5,445                     | 136            | 106               | 0·27        | 27  |
| Dried whole, spray ...         | 1 lb. | 90 0                    | 3,185      | 2,915          | 4,235                     | 106            | 82                | 0·21        | 21  |
| Dried, skimmed, roller...      | Bulk  | 20 0                    | 760        | 18,190         | 26,470                    | 662            | 513               | 1·32        | 132   |
| Dried, skimmed, roller...      | 1 lb. | 40 0                    | 380        | 9,095          | 13,235                    | 331            | 256               | 0·66        | 66  |
| Dried, skimmed, spray...       | Bulk  | 32 0                    | 475        | 11,370         | 16,545                    | 413            | 320               | 0·83        | 83  |
| Dried, skimmed, spray...       | 1 lb. | 52 0                    | 295        | 6,995          | 10,180                    | 254            | 197               | 0·51        | 51  |

\* Packages of from 56 lbs, to 112 lbs.

† For explanation see paragraph 9.



day, but it is believed that they may be regarded as broadly typical of the c.i.f. prices at Colonial ports of the cheapest type of good quality product. While, therefore, too much reliance should not be placed on the calculations based on these prices, the variations from them are not likely to be sufficiently wide to affect materially the general conclusions.

6. From this table various points of interest emerge. In the first place, naturally the whole milks provide much more fat than the skimmed milks, and dried whole milk will provide at least twice as much as condensed whole milk, whether sweetened or unsweetened.\*

7. As regards protein, dried skimmed milk, especially packed in bulk, will contain several times as much as any other form of processed milk. At the prices given in the table skimmed milk dried by the roller process and packed in bulk will yield more than seven times as much protein as condensed whole milk and more than four times as much as condensed skimmed milk. It must be remembered, however, that some portion of the proteins of roller-dried products is rendered insoluble during manufacture and cannot be reconverted into soluble form when mixed with water. It is therefore less convenient to handle and also less palatable to consume than spray-dried milk. Though it is possible that the proteins, even if not dissolved before consumption, are in fact digested, these factors do undoubtedly reduce to some extent the advantage of roller-dried milk. But even the more expensive spray-dried skimmed milk will yield on the figures given more than four times as much protein as condensed whole milk and nearly three times as much as condensed skimmed milk.

8. In regard to calcium, phosphorus and iron, the table shows that in every case dried skimmed milk gives several times as large a quantity as any other form of processed milk. All these figures are very striking. Compare, for instance, the advantages of roller-dried skimmed milk packed in bulk with the condensed whole sweetened milk most usually consumed at present. The figures for other forms of dried skimmed milk are scarcely less striking.

9. Vitamin content is not shown in the table. To estimate this it is necessary to take into account (1) the original vitamin content of the raw milk used, (2) the effects of manufacture. As regards the original vitamin content a column (column 10) has been included in Table II headed "raw milk equivalent," i.e., the quantity of raw milk (whole or skimmed as may be) which will have been used in the manufacture of that quantity of the final product obtained for £1. The skimmed milk products, because of the very low fat content, will naturally be lowest in vitamins A and D; the remaining vitamins will have been present in the raw milk in the relative proportions shown in column 10. The vitamin content of the final product will, however, have changed considerably as the result of manufacture. While it is not possible with present knowledge to state exactly what the effect of the various processes will be, some general indication can be given. Vitamins D and the B<sub>2</sub> complex will be unaffected. Vitamin B<sub>1</sub> (of which, however, fresh milk is not an important source) will also be unaffected except in the case of evaporated milk. Dried milks will lose vitamin A through oxidation processes. Vitamin C (of which, however, fresh milk is never an important source) will be almost entirely destroyed in all cases. Comparing therefore the dried skimmed milks and condensed sweetened whole milk, the net result is likely to be that condensed sweetened whole milk will have a distinct advantage as to vitamin A and, to a somewhat less extent, vitamin D, but that the dried skimmed milks will have a big advantage in regard to the vitamin B group.

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\* Though, as already explained, dried whole milk may not be suitable for use in Colonial conditions.



10. In brief, £1 spent on either form of dried skimmed milk will purchase a very great deal more protein, calcium, phosphorus, iron and the B vitamins than £1 spent on any form of manufactured whole milk. On the other hand, any form of whole milk will yield several times as much fat and vitamins A and D as any form of skimmed milk.\*

11. It must be repeated that the variations in price from territory to territory and from time to time are so great that it does not follow that exactly similar relationships will hold in any particular Colonial Dependency, and it is important before any action is based upon these calculations that their validity should be tested in the circumstances of each territory. But the advantage of dried skimmed milk in everything except fat and vitamins A and D seems so great that any alteration in prices is not likely to challenge it.

12. A similar conclusion results from consideration of the following facts:—

1 cwt. of condensed whole milk contains about 30 gallons of full cream milk, while 1 cwt. of dried skimmed milk contains about 125 gallons of skimmed milk, whether spray-dried or roller-dried.†

Skimmed milk is much cheaper to buy in the raw state than full cream milk. Indeed, in butter manufacturing countries it can often be obtained for practically nothing. The cost of 125 gallons of skimmed milk would normally be less than the cost of 30 gallons of full cream milk.

Dried milk is considerably cheaper to manufacture than condensed milk.

These facts point to the conclusion that by importing dried skimmed milk rather than condensed whole milk a Colony should obtain the equivalent of 125 gallons of skimmed milk for considerably less cost than the equivalent of 30 gallons of whole milk.

13. There are however two factors which have not yet been taken into account which might conceivably modify these conclusions. The first is the keeping qualities of the various forms of milk and the second is the relative suitability of the two kinds of milk for infants.

14. As regards the relative keeping qualities, the keeping quality of condensed sweetened whole milk and condensed sweetened skimmed milk is likely to be the same. Dried whole milk (as explained in an earlier footnote) is somewhat liable to oxidise unless packed and stored under special conditions which are expensive. Similarly condensed unsweetened milk will be liable to putrefaction. The main question would therefore appear to be the relative keeping qualities of condensed sweetened milk, whether whole or skimmed, on the one hand and of dried skimmed milk on the other hand. On this question the following remarks may be made.

15. Condensed sweetened milk though not sterilised in manufacture will remain wholesome for a long time in the tin if the original milk was clean and the manufacture was carried out under hygienic conditions, for the sugar content is sufficiently high to prevent the growth of micro-organisms. Once opened, the milk will remain edible for an appreciable time, but it is liable to become progressively more dangerous to health. The tin cannot usually be tightly closed again, since it has normally to be cut open by a tin opener, and the milk can therefore easily become contaminated by insanitary handling or by flies to which on account of its sweetness it is

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\* Milk is not normally consumed for its carbohydrate content, but skimmed milk, dried or condensed, gives more than whole milk whether dried or condensed.

† 1 cwt. of condensed skimmed milk contains about 34 gallons of skimmed milk. 1 cwt. of dried whole milk contains about 90 gallons of full cream milk.



very attractive. The sugar content will be sufficient to prevent multiplication of disease-producing organisms in the milk itself, but these may survive and multiply rapidly as soon as the milk is diluted for use. It is probable therefore that condensed sweetened milk will find its greatest use in individual households where the supply will be obtained in small tins and where the risk of serious contamination such as might occur in bulk supplies will be minimised.

16. Dried skimmed milk if manufactured under hygienic conditions should have a low bacterial content on leaving the factory, and the unopened tin should keep at least as well as condensed sweetened milk. Once the tin has been opened it has usually the advantage over condensed sweetened milk that, unlike the most usual forms of condensed milk, it is packed in containers with lids which can be replaced so that the container is kept more or less airtight. If it remains open and able to absorb moisture the usual defects that develop are, first a loss of solubility, secondly a stale flavour and odour. Some slight tallowiness and rancidity might also develop as a result of decomposition of the small quantity of fat. Under such circumstances the product will fairly quickly lose attractiveness and may ultimately become quite unpalatable, though it is unlikely to become actively dangerous to health unless a very high degree of moisture is absorbed and contamination has been great. Dried milk is not so readily suited for household use as condensed milk, since if it is to be used as a liquid it requires reconstitution. It can, however, be used in dry form in all sorts of cooked dishes, bread, etc., and it can be readily handled in bulk, provided satisfactory containers are used.

17. The general conclusion as regards keeping qualities seems to be that condensed sweetened milk is more convenient for household use but that dried skimmed milk is perfectly suitable for institutional use or for use in schemes which involve the supplementary feeding of selected groups of the population. We have already noted that spray dried milk is both more convenient to handle and more palatable to consume than roller dried milk but roller dried milk is considerably the cheaper article.

18. The other factor to be taken into account is the relative suitability of the two milks for infants. Skimmed milk in any form is not suitable as the sole food for infants, and there is considerable risk that dried skimmed milk if used by the general public might be used for this purpose. Against this risk must be set the advantages of a larger supply of proteins, calcium, phosphorus, iron, etc., that would be obtained by the general population by the general use of dried skimmed milk. To some extent the risk might be guarded against by requiring skimmed milk to be clearly marked "not suitable as a sole food for infants", but the value of this would clearly be small in a largely illiterate community. Condensed whole sweetened milk is also not an ideal food for infants, because the large quantity of sugar it contains replaces Calories that should be obtained from more valuable foods containing fats, proteins, etc.

19. The conclusions which emerge from this memorandum may now be summarised as follows:—

(1) As regards keeping qualities and ease of handling, dried whole milk cannot at present be recommended for general use in colonial conditions. Unsweetened milk is also liable to putrefaction. The real choice thus lies between condensed sweetened whole milk and dried skimmed milk. The condensed product is more convenient for household use but dried skimmed milk is just as suitable for use in institutions or for the supplementary feeding of groups of the population, e.g., school children.

(2) £1 spent on condensed sweetened whole milk, or indeed on any form of whole milk, will purchase considerably more fats and vitamins A and D than £1 spent on any form of skimmed milk.

(3) But £1 spent on the purchase of dried skimmed milk, will give a very much larger quantity of proteins, calcium, phosphorus, iron and the B vitamins than £1 spent on condensed whole sweetened or any other form of processed milk.

(4) No form of skimmed milk is suitable as a sole food for infants. If it were made available for general consumption, the risk of its use for this purpose would have to be set off against the advantage to the general population of increased quantities of protein, calcium, etc., being made available. Condensed whole sweetened milk is also not an ideal food for infants.

#### APPENDIX 4.

##### Existing and improved scales of diet issued to employees of Rhokana Corporation, Ltd.

TABLE 1.

EXISTING DIETARY SCALE FOR MALE EMPLOYEES, WOMEN AND CHILDREN.

##### MEN.

| Foodstuff.              | Weight<br>(oz.). | Weekly<br>Ration.<br>Calorie<br>(oz.). | Total<br>Calories. | Daily Ration.    |           |
|-------------------------|------------------|--|--------------------|------------------|-----------|
|                         |                  |  |                    | Weight<br>(oz.). | Calories. |
| Maize meal ... ..       | 168              | 106·0                                  | 17,808             | 24·0             | 2,544·0   |
| Meat ... ..             | 44               | 35·4                                   | 1,558              | 6·3              | 222·5     |
| Vegetable and fruit ... | 47               | 20·7                                   | 973                | 6·7              | 139·0     |
| Peanuts ... ..          | 7                | 160·0                                  | 1,120              | 1·0              | 160·0     |
| Beans ... ..            | 47               | 97·4                                   | 4,581              | 6·7              | 654·5     |
| Biscuit... ..           | 16               | 102·0                                  | 1,632              | 2·3              | 233·0     |
| Fat ... ..              | 4                | 262·0                                  | 1,048              | 0·6              | 149·7     |
| Salt ... ..             | 3·5              | —                                      | —                  | 0·5              | —         |
| Native beer ... ..      | 140              | 10·5                                   | 1,477              | 20·0             | 211·0     |
| Totals ... ..           | 476·5            | —                                      | 30,197             | 68·1             | 4,313·7   |

##### ADDITIONAL TO MEN UNDERGROUND.

|               |       |      |        |      |         |
|---------------|-------|------|--------|------|---------|
| Cocoa ... ..  | 140   | 1·5  | 210    | 20·0 | 30·0    |
| Bread ... ..  | 28    | 64·0 | 1,792  | 4·0  | 256·0   |
| Totals ... .. | 644·5 | —    | 32,199 | 92·1 | 4,599·7 |

##### WOMEN.

|                |     |      |        |      |         |
|----------------|-----|------|--------|------|---------|
| Mealies ... .. | 112 | 99·7 | 11,166 | 16·0 | 1,595·2 |
| Offal ... ..   | 32  | 40·3 | 1,290  | 4·6  | 184·3   |
| Totals ... ..  | 144 | —    | 12,456 | 20·6 | 1,779·5 |

##### CHILDREN.

|                |    |      |       |     |       |
|----------------|----|------|-------|-----|-------|
| Mealies ... .. | 48 | 99·7 | 4,786 | 6·9 | 683·7 |
|----------------|----|------|-------|-----|-------|



TABLE 2.  
IMPROVED DIETARY SCALE FOR NATIVE EMPLOYEES, WOMEN AND CHILDREN.

| Foodstuff.                            | Ration.       |              | Calorie—Value.    |                    |                  |
|---------------------------------------|---------------|--------------|-------------------|--------------------|------------------|
|                                       | Oz./<br>week. | Oz./<br>day. | Calorie<br>(oz.). | Total<br>Calories. | Calorie/<br>day. |
| Maize meal ... ..                     | 112.0         | 16.0         | 106.0             | 11,872             | 1,696            |
| Meat ... ..                           | 84.0          | 12.0         | 35.4              | 2,974              | 425              |
| Vegetable and fruit ...               | 47.0          | 6.7          | 20.7              | 973                | 139              |
| Peanuts ... ..                        | 7.0           | 1.0          | 160.0             | 1,120              | 160              |
| Beans ... ..                          | 31.5          | 4.5          | 97.4              | 3,068              | 438              |
| Wheat roll ... ..                     | 42.0          | 6.0          | 68.6              | 2,881              | 412              |
| Fat ... ..                            | 5.0           | 0.7          | 262.0             | 1,310              | 183              |
| Salt ... ..                           | 3.5           | 0.5          | —                 | —                  | —                |
| Native beer ... ..                    | 140.0         | 20.0         | 10.5              | 1,470              | 210              |
| Total, surface ...                    | 472.0         | 67.4         | —                 | 25,668             | 3,663            |
| ADDITIONAL FOR UNDERGROUND EMPLOYEES. |               |              |                   |                    |                  |
| Cocoa ... ..                          | 140.0         | 20.0         | 1.5               | 210                | 30               |
| Sugar ... ..                          | 7.0           | 1.0          | 116.0             | 812                | 116              |
| Bread ... ..                          | 28.0          | 4.0          | 64.0              | 1,792              | 256              |
| Total, underground                    | 647.0         | 92.4         | —                 | 28,482             | 4,065            |
| WOMEN.                                |               |              |                   |                    |                  |
| Mealies ... ..                        | 112.0         | 16.0         | 99.7              | 11,166             | 1,595            |
| Offal ... ..                          | 32.0          | 4.6          | 40.3              | 1,290              | 184              |
| Wheat roll ... ..                     | 42.0          | 6.0          | 68.6              | 2,881              | 412              |
| Total, Women ...                      | 186.0         | 26.6         | —                 | 15,337             | 2,191            |
| CHILDREN.                             |               |              |                   |                    |                  |
| Mealies ... ..                        | 48.0          | 6.9          | 99.7              | 4,786              | 684              |
| Wheat roll ... ..                     | 42.0          | 6.0          | 68.6              | 2,881              | 412              |
| Fat ... ..                            | 4.5           | 0.7          | 262.0             | 1,310              | 183              |
| Offal ... ..                          | 32.0          | 4.6          | 40.3              | 1,290              | 184              |
| Total, Children ...                   | 126.5         | 18.2         | —                 | 10,267             | 1,463            |

## APPENDIX 5.

**The place of sugar in the diet.***Memorandum by Dr. F. C. Kelly, Ph.D.*

In the despatch from Jamaica, the Governor makes special reference to the place of sugar in the diet and considers that enquiry is desirable into the food value of sugarcane, raw sugar and molasses as distinct from refined sugar which is completely free of fat, protein, vitamins or mineral elements. In the sugar producing countries of which he has experience the belief is apparently held by many that the chewing of sugarcane, a practice common among labourers and cane-cutters, has a valuable and stimulating effect not solely due to the commonly accepted food value of sugarcane as a source of carbohydrate. A survey of the relevant literature reveals but one reference to similar observations elsewhere<sup>(1)</sup>. In the early days of the sugar industry in the United States, the sugar mill was regarded as a very healthy place in which to work. The breathing of the vapours escaping from cauldrons during the evaporation of cane juice was considered beneficial and large quantities of cane juice were drunk and other products of the sugar factory included in the diet.

The suggestion is that these beneficial effects may be attributable to some special nutritive properties present in cane juice and crude sugar but destroyed or eliminated in the process of refinement. In view of this, several workers have investigated both the vitamin and mineral content of sugarcane and its products. For convenience the results of these investigations are given below in tabular form.

TABLE I.  
VITAMIN CONTENT.

| Sugar Cane.   | A      | B Complex.  | C      | D      | Reference.  |
|---|--------|-------------|--------|--------|---|
| <i>Fresh juice ...</i>                              | Absent | Poor source | —      | Absent | Nelson (E. M.)<br>and Jones <sup>(1)</sup> .            |
| „ „ ...   | —      | —           | Absent | —      | Delf <sup>(2)</sup> .                                   |
| „ „ ...   | —      | —           | 0.2*   | —      | Chakraborty <sup>(3)</sup> .                            |
| „ „ ...   | —      | —           | 0.4*   | —      | Chi and Read <sup>(4)</sup> .                           |
| <i>Products of<br/>Evaporation :<br/>Cane Syrup</i> | —      | Absent      | —      | —      | Nelson (E. M.)<br>and Jones <sup>(1)</sup> .            |
| <i>Molasses<br/>(blackstrap)</i>                    | —      | Absent      | —      | —      | Nelson (E. M.)<br>and Jones <sup>(1)</sup> .            |
| „ „   | Absent | Good source | —      | —      | Nelson (V. E.)<br>Heller and<br>Fulmer <sup>(5)</sup> . |

From the above findings it may be concluded that, so far as present knowledge goes, sugarcane juice and the syrups and molasses obtained therefrom by evaporation, are of no account as sources of vitamins A, C and D. Sugarcane juice undoubtedly contains vitamin B; but it cannot

\* mg. ascorbic acid per 100 ml.



TABLE 2.

MINERAL CONTENT OF SUGARCANE PRODUCTS.  
(Per cent., fresh basis.)

|                 | Description.   | Moisture. | Ash. | Iron.   | Copper. | Calcium. | Phosphorus. | Reference. |
|-----------------|--|-----------|------|---------|---------|----------|-------------|------------|
| Sugarcane syrup | Average of 10 samples; method of evaporation not stated.         | 25.81     | 0.81 | 0.0029  | —       | 0.049    | 0.034       | 6          |
| "               | Average of 24 samples evaporated on iron pans.                   | 23.51     | 0.96 | 0.0049  | 0.00027 | 0.055    | 0.035       | 7          |
| "               | Average of 3 samples evaporated on iron pans.                    | 27.45     | 1.93 | 0.0107  | 0.00005 | —        | —           | 8          |
| "               | Average of 7 samples evaporated on iron pans.                    | 24.98     | —    | 0.00718 | —       | —        | —           | 9          |
| "               | Average of 11 samples evaporated on copper pans.                 | 23.93     | 1.11 | 0.0021  | 0.00040 | 0.090    | 0.031       | 7          |
| "               | Average of 7 samples evaporated on copper pans.                  | 22.32     | —    | 0.00142 | —       | —        | —           | 9          |
| "               | Average of 7 samples evaporated on porcelain pans.               | 22.58     | —    | 0.00192 | —       | —        | —           | 9          |
| Molasses        | Average of 4 different varieties marketed for human consumption. | 22.63     | 5.41 | 0.0185  | 0.0010  | 0.3193   | 0.0562      | 7          |
| "               | Blackstrap; not used for human consumption.                      | 21.67     | 7.39 | 0.0982  | 0.0010  | 0.7925   | 0.0712      | 7          |
| Brown sugar     | Average of 3 different varieties                                 | 2.86      | 1.60 | 0.0027  | 0.00059 | 0.0874   | 0.0105      | 7          |

Iron content of some other foods high in iron: Beef (lean), 0.0035; Egg yolk, 0.0086; Lentils, 0.0076; Spinach, 0.0030; Ox Liver, 0.0067, per cent. fresh basis.

be regarded as a rich source. Nelson (E. M.) and Jones found that the juice from the upper portion of cane stalks was definitely richer in this vitamin than juice from the lower portions. The recorded results on the vitamin B content of molasses are conflicting. Nelson (E. M.) and Jones found none in blackstrap molasses, whereas Nelson (V. E.) and his co-workers conclude that it is a very good source of vitamin B. Whichever may be correct, however, the vitamin B content of blackstrap molasses is a question of doubtful practical significance so far as human nutrition is concerned since this product is used primarily in the feeding of livestock.

In Table 2, the mineral content of sugarcane products is compared with that of certain other foodstuffs selected on account of their high iron content.

In general, syrups and molasses are good sources of iron although, as is to be expected, syrups evaporated in copper or porcelain pans contain less than those evaporated in iron pans. Investigations undertaken by Sheets and Frazier<sup>(8)</sup> showed that sugarcane syrups contain substances (iron and copper) quite potent in the production of haemoglobin in the rat although none of the syrups tested was quite as efficient as calf liver. When sugarcane syrup was fed to anaemic rats at a level of 0.5 mg. of iron daily, the haemoglobin content of the blood increased from 5.1 g. to 11.2 g. per 100 cc. in 16 weeks.

From these studies of the vitamin and mineral content of cane juice and crude sugar products, our conclusion is that there is as yet insufficient experimental evidence to decide on scientific grounds whether the benefits to health reported from some quarters as due to the consumption of sugar in the raw state are likely to be real or are only fancied. In areas where the customary dietaries are known to be deficient in iron, however, sugarcane syrups and molasses might find a place as valuable supplementary sources of iron, especially if other foodstuffs high in iron are not available.

On the more general aspects of the place of sugar in the dietary, we maintain the already accepted view of dietary experts that *excessive* consumption is to be discouraged. Over-indulgence in sugar causes disturbances of digestion and absorption thus blunting the appetite for more essential foods. It is responsible for abnormal water retention and overactivity of the pancreas and liver; and, it is urged by many, is a factor predisposing to certain eye diseases, catarrhal conditions, dental caries and diabetes. Cases have also been described of a condition involving high water retention and dilation of the heart, considered to be due to partial vitamin B<sub>1</sub> deficiency, caused by excessive sugar consumption<sup>(10, 11, 12, 13, 14)</sup>.

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## APPENDIX 6.

### Rice and its importance for Human Nutrition.

*Memorandum by Dr. B. S. Platt, M.B., Ch.B., M.Sc., Ph.D.*

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### Extent and importance of rice cultivation.

1. Rice is at the present time the staple food of nearly one half of the world's population. It is being produced in amounts sufficient to supply about one fifth of the calorie requirements per capita per annum. There are about 200 million acres of land under rice cultivation, two thirds of this area being shared equally between China and British India; in the latter about 67 million acres are under rice out of a total of 186 million acres devoted to the production of food crops.<sup>(33)\*</sup> Of the total rice production in the world, it is estimated that as much as 60 per cent. is grown in the British Empire. Rice is placed first amongst foodstuffs of world importance, yet, notwithstanding the scale on which it is being produced, it has been stated<sup>(43)\*</sup> that only about 3 per cent. of suitable land in tropical countries is under rice culture.

2. Peoples using rice as their staple food consume in the form of rice as much as 80 to 90 per cent. (measured in terms of energy value) of their total food intake. They are usually peoples living on "marginal" diets, and the first consideration is the provision of sufficient amounts of food to cover their energy requirements. This is the situation, for example, in India, of which Sir John Russell writes:

"I am very strongly of the opinion that the best varieties (of cereals) for home food supply are those that give the largest yields per acre. The really vital matter is the food value per acre, not per ton of produce."

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\* The numbers on this page and through the rest of the text refer to the authorities quoted in the Bibliography, which appears on page 192.

### Variation in yields of rice.

3. Yields of rice vary considerably. Big differences are recorded between "dry land"\* and "upland" rices (i.e., those grown on land permanently under cultivation and relying on rain for water, or produced on freshly cleared hillsides or in places having a heavy rainfall), and the "irrigated" or "swamp" rices raised on land flooded by irrigation or natural inundation. Some average yields for the years 1929-33 are:

|        |     |     |     |     |                      |
|--------|-----|-----|-----|-----|----------------------|
| Italy  | ... | ... | ... | ... | 93 bushels per acre. |
| Japan  | ... | ... | ... | ... | 68 bushels per acre. |
| China  | ... | ... | ... | ... | 67 bushels per acre. |
| U.S.A. | ... | ... | ... | ... | 47 bushels per acre. |
| India  | ... | ... | ... | ... | 29 bushels per acre. |

The "cup-weight" of rice varies considerably, so that the bushel-weight is variously recorded as being 40-50 lb. per bushel. Weights per unit area are, however, recorded<sup>(5)</sup> in a recent survey in China, in which maximum and minimum yields are given as 84.46 and 10.74 quintals per hectare, i.e., 7,700 and 960 lb. per acre respectively. In Malaya, average yields have been reported<sup>(8)</sup> of 1,545 lb. per acre for "wet" rice, and 817 lb. per acre for "dry" rice. The average yield for Japan and China is close upon 3,000 lb. per acre per year; in some places it should be noted that two or even three crops may be obtained off the same land in the one year.

### Factors affecting the yield of rice.

4. The yield of rice is affected by a number of factors, of which seed, soil, water and climate are the most important.

"Seed should be sown that is clean, viable, and free from mixtures of different types, of obnoxious weed seeds, and of red rice. Fields should be irrigated and drained at the right time. The crop should be harvested at the right stage of maturity. When harvested with a binder, the rice should be shocked promptly in such a way that it will cure satisfactorily before it is threshed. The crop should be threshed as soon as the kernels are well cured."<sup>(36)</sup>

### Importance of "protective" principles in staple crops.

5. More and more emphasis is being laid in nutrition precepts on the importance of "protective" foodstuffs; these are in general costlier than the "energy bearing" foods. The protective principles—proteins, minerals and vitamins—are, however, contained in the latter class of food to some extent. When, as is the case with the predominantly rice-eating peoples, they cannot afford money, land or labour to provide themselves with sufficient protective foods, it becomes necessary to ensure that their staples shall as far as possible contribute the protective principles to their diet. There are differences in nutritive values of different kinds of rice, and of the same rice grown under different conditions with respect to amount and nature of water supply, soil composition, etc.; but such variations of food value are of secondary importance in comparison with what can be attained by measures directed towards the conservation of the food value of the rice ordinarily produced.

### Calorific value of rice produced per acre.

6. Assuming a milling yield of 65 per cent. and a calorie value for rice of 1,600 per pound, then—when a yield of 3,000 lb. per acre is obtained—there are 3.12 million calories produced per acre in a year. It would be difficult to equal this production over so large an area in

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\* Dry land and upland rices will be referred to collectively as "dry" rice, and irrigated rice as "wet" rice.



any other form of food; in fact it is generally conceded that food of two or three times the energy value can be obtained per acre in the form of rice as compared with wheat. This holds good for rice as against wheat in China itself, and for rice production in China as against wheat production in the United States of America.

Composition of rice.

7. The following table for the composition of rice has been compiled from various sources; it will be found that most published analyses approximate to these values.

TABLE I.  
REPRESENTATIVE VALUES FOR THE COMPOSITION OF RICE.

|                                 |      |                 |     |     |      |     | Hulled Rice.                     | Polished Rice. |
|---------------------------------|------|-----------------|-----|-----|------|-----|----------------------------------|----------------|
| Wt. of 100 kernels.             | Gms. | ...             | ... | ... | ...  | ... | 2.47                             | 2.13           |
| Moisture                        | ...  | Gms.            | per | 100 | gms. | ... | 12.0                             | 12.0           |
| Protein                         | ...  | ...             | ... | ... | ...  | ... | 8.0                              | 7.0            |
| Fat                             | ...  | ...             | ... | ... | ...  | ... | 2.0                              | 0.25           |
| Fibre                           | ...  | ...             | ... | ... | ...  | ... | 1.0                              | 0.5            |
| Carbohydrate (other than fibre) | ...  | ...             | ... | ... | ...  | ... | 75.5                             | 80.0           |
| Ash                             | ...  | ...             | ... | ... | ...  | ... | 1.5                              | 0.5            |
| Calories                        | ...  | ...             | ... | ... | ...  | ... | 350                              | 350            |
| Calcium                         | ...  | ...             | ... | ... | ...  | ... | 0.02                             | 0.01           |
| Phosphorus                      | ...  | ...             | ... | ... | ...  | ... | 0.2                              | 0.1            |
| Iron (available)                | ...  | Mgs.            | ... | ... | ...  | ... | 1.7                              | 0.4            |
| Copper                          | ...  | Microgms.       | per | 100 | gms. | ... | —                                | 1.0            |
| Manganese                       | ...  | ...             | ... | ... | ...  | ... | —                                | 14.0           |
| Iodine                          | ...  | ...             | ... | ... | ...  | ... | 6.0                              | 2.5            |
| Vitamin A                       | ...  | Internat. units | per | 100 | gms. | ... | 50                               | ?              |
| Vitamin B1                      | ...  | ...             | ... | ... | ...  | ... | 100                              | 20-40          |
| Vitamin B2                      | ...  | ...             | ... | ... | ...  | ... | Present                          | —              |
| Vitamin C                       | ...  | ...             | ... | ... | ...  | ... | 0                                | 0              |
| Vitamin E                       | ...  | ...             | ... | ... | ...  | ... | Rice oil is an excellent source. | —              |

Constituents of rice important in nutrition.

8. The proteins of rice are generally considered to be of good quality; its biological value for man is shown in the following list along with those of some others from common sources.

| Protein.   |     |     |     |     |     |     | Biological value for man. |
|------------|-----|-----|-----|-----|-----|-----|---------------------------|
| Beef       | ... | ... | ... | ... | ... | ... | 104                       |
| Haddock    | ... | ... | ... | ... | ... | ... | 85-103                    |
| Milk       | ... | ... | ... | ... | ... | ... | 51-99                     |
| Rice flour | ... | ... | ... | ... | ... | ... | 83-86                     |
| Potato     | ... | ... | ... | ... | ... | ... | 56-80                     |
| Bread      | ... | ... | ... | ... | ... | ... | 25-80                     |

Some amino acids—notably cystine, histidine, lysine and tryptophane—essential for good nutrition are found<sup>(9, 10)</sup> in rice proteins in amounts

which compare favourably with those occurring in other proteins held to be of good value. It has indeed been maintained<sup>(38)</sup> that if the energy requirements of a subject are met by rice alone, either during growth or for maintenance in adult life, then the protein needs will be satisfied.

9. The amounts of mineral constituents of rice are low, and even when large quantities of rice are eaten daily the needs for calcium, phosphorus and iron would not be met either by unmilled or polished rice.

10. Unmilled rice contains only small amounts of the precursors of vitamin A; it is, however, an excellent source of fat-soluble vitamin E<sup>(3)</sup>. It should be remarked that both these essential substances will be largely removed in the course of milling, as more than two-thirds of the oil in rice is taken off with the bran<sup>(42)</sup>. There is no evidence that rice contains vitamin C; in common with a number of other cereals, however, this substance develops<sup>(25)</sup> in the course of germination. Rice bran, and therefore unmilled rice, contains some of the vitamin complex B<sub>2</sub><sup>(27)</sup>. Most important of all the vitamins in connection with rice is vitamin B<sub>1</sub>, the deficiency of which leads to the occurrence of beri beri. This substance is present in amounts in unmilled rice adequate for proper human nutrition, but the losses are so great in storage, processing and cooking that in some circumstances intake of vitamin B<sub>1</sub> in the rice is very small. It will now be considered what the effects of various treatments are on these components of special nutritive significance.

#### Effects on rice of conditions of ripening and harvesting.

11. Whilst it is known that, in general, profound changes in the chemical composition of seeds occur during ripening, only gross observations have been made on rice. As a matter of practical experience, it is appreciated that milling yields vary considerably with conditions of harvesting. The regulation of irrigation is a critical factor in ripening, and provision should be made for the removal of water as the rice approaches maturity. Harvesting must proceed rapidly as soon as a proper state of ripening has been reached, on account of the damage and losses resulting from lodging, sun-checking, unseasonable rains and depredation by birds. It has been shown<sup>(36)</sup> for a number of varieties of rice that optimal conditions of harvesting obtain when the standing rice has a moisture content of from 28 to 23 per cent. This appears to be reached in a characteristic number of days after the panicles (heads) are formed, or in a period which elapses after the heads begin to droop. The kernels in the upper parts of the panicles are found to be fully mature\* whilst in the lower parts of the head they have reached the "hard-dough" stage. Practical rules relating the optimal water content of the standing grain to the best conditions for harvesting may need to be determined for different varieties and for different local conditions. When appropriate measures are taken at harvesting, the moisture of the grain gradually decreases and is followed by a "marked increase in the weight of the air-dried kernel, in the yield per acre, in the percentage of the whole kernel obtained in the test for milling and in germination." Attempts to control the moisture in rice, whether by natural or artificial means, are fraught with difficulties. Rapid drying, for example, in the windrows and shocks (stooks) in the field may lead to stresses in the grain causing fractures called sun-checks;<sup>(4)</sup> the grain breaks along these in the course of milling, and there is considerable reduction in the yield of whole grain.

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\* A guide to immaturity is the proportion of chalky kernels (commonly called "white belly"—a chalky mass appearing along that keel of the rice grain in which the embryo is situated) found in the milled product.



### Methods of storage of rice and its relation to food values.

12. During storage, serious changes detrimental to the value of the rice as food may occur. Small producers keep the grain—with the husk intact—in bags, baskets or some form of granary. It is generally believed that rice stored unhulled\* is safe from damage by insects; careful investigation, however, will show that this is not necessarily the case. If a count of healthy and damaged grains is taken, it will be found that even under good conditions there may be as much as 8 to 10 per cent. affected by weevils after less than one year in store. This fact does not usually obtrude itself, since the hollowed grains are removed by the winnowing<sup>(28)</sup> to which the paddy is subjected before it is dehusked. It is possible, as will be shown, to store hulled rice under such conditions that it emerges as good a product, if not better, than that stored in the husk. This is a matter of considerable importance, since for storage and transport the presence of the husk doubles the bulk and is half as heavy again as the de-husked product.

13. There are four chief factors which need to be reckoned with in providing for the successful storage of rice. These are temperature, moisture content, contamination with insect pests and the amount of oxygen available in the store. All these factors are to some degree inter-related. A high moisture content leads to "self-heating," in part due to favourable conditions for the proliferation and metabolism of insects and micro-organisms; the removal of insects by some process of fumigation results in a lowering of temperature of the store. Rice in the husk heats less than hulled rice; and, other conditions being equal, there is less loss from damage by weevils when rice is kept in the husk during storage. Milled rice is very rapidly destroyed by weevil. It is important in the control of infestation by weevil to put the rice into store immediately after harvest, before it is heavily inoculated; also to take care that the container is free from infested debris. In the presence of carbon dioxide, the development of insects is inhibited, and it appears as if the respiration and metabolic activities of the grain are also depressed. It will be clear that this condition of carbon dioxide laden atmosphere could be attained by allowing the seeds to respire in an airtight container.

14. There is a long experience<sup>(6)</sup> of storage of grain in air-tight containers in India, Japan and Malta. In a Royal Society Report<sup>(7)</sup> on Grain Pests the advantages of this method for the storage of wheat were stated to be:

- (i) Sterilisation from insects and vermin.
- (ii) Prevention of access of more insects and vermin.
- (iii) Prevention of mildew even at high temperatures.
- (iv) Prevention of heating even with high moisture content, though the development of acidity is not avoided as this arises as a result of anaerobic fermentation.
- (v) Avoidance of uptake of moisture from the air, i.e. if the grain is put in dry it remains dry.
- (vi) Labour and expense of turning the grain over is saved.

Since this time (1920) investigators in Japan have applied these principles to the storage of rice. They<sup>(17)</sup> have found stocks of hulled rice, dried in the sun to 11-13 per cent. moisture and stored in hermetically sealed containers, that are equivalent after 26 and 28 years storage to that stored in straw bags for two and three years respectively. The properties investigated<sup>(12)</sup> include taste, smell, palatability, hardness, ability to absorb

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\* Un-husked or un-hulled, rough and "paddy" rice are terms in use implying that the grain is still in the husk.

water, germination power and vitamin B<sub>1</sub> content. The two latter properties appear<sup>(18)</sup> to run parallel. On the basis of the result of many years of investigation, the Japanese recommend<sup>(18)</sup> for storage in air-tight or carbon dioxide containing chambers, a water content of 10 to 12 per cent. if required to store for 3 years or more; 14 per cent., for storage of from 1 to 2 years, and if the grain contains 16 to 18 per cent. of water it is not safe to store for more than a year.

15. In the consideration of methods of rice storage, preference should be given to those in which the vitamin B<sub>1</sub> content is conserved as far as possible, for it is well established now that insufficiency of this substance in the diet leads to disease of the nervous system, to disturbance of metabolism in several tissues of the body including muscle, to impaired function of the heart and circulatory system, and to derangements in the digestive system, one of the earliest to appear being a small appetite. The fully developed disease which follows deficiency of vitamin B<sub>1</sub> is beri-beri; it can be prevented by ingestion of sufficient vitamin B<sub>1</sub>, and the most severe and previously fatal cases have been cured<sup>(21)</sup> by doses of 3-5 milligrams of the pure natural or synthetic substance.

16. The effect on the vitamin B<sub>1</sub> content of grain stored under various conditions is shown in the data presented in tables 2a and 2b.

TABLE 2A.

*The vitamin B<sub>1</sub> content of hulled rice after storage under various conditions.*

| Length of time stored. | Method of storage.  | Percentage of value for vitamin B <sub>1</sub> in fresh rice. |
|------------------------|---|---|
| 1 year ...             | In straw bags <sup>(15)</sup> ... ..  | 92 per cent.  |
| 2 years ...            | „ „ „ <sup>(15)</sup> ... ..  | 82 „ „  |
| 3 „ ...                | „ „ „ <sup>(15)</sup> ... ..  | 56 „ „  |
| 4 „ ...                | „ „ „ <sup>(15)</sup> ... ..  | 23 „ „  |
| 4 „ ...                | In airtight container (moisture 10 per cent.) <sup>(16)</sup> ... ..                | Equal to new rice.  |
| 4 „ ...                | In carbon dioxide (moisture 11.5 per cent.) <sup>(16)</sup> ... ..                  | Equal to new rice.  |
| 26-28 years ...        | In airtight container (sun dried ; moisture 11-13 per cent.) <sup>(17)</sup> ... .. | 84—54 per cent.   |

TABLE 2B.

*Comparison of vitamin B<sub>1</sub> content of hulled and unhulled rice after storage*

|   | Percentage of value for vitamin B <sub>1</sub> in fresh rice. |                                     |
|---|---|-------------------------------------|
|   | Hulled.   | Unhulled.                           |
| Two varieties stored in straw bags for 2 years. <sup>(21)</sup> | (a) 82 per cent.  | (a) i. 75.4 per cent.<br>ii. 87.0 „ |
|   | (b) 95 „  | (b) i. 98.0 „<br>ii. 84.0 „         |
| Stored in airtight concrete silo for 3 years. <sup>(20)</sup>   | Equal to fresh rice.  | 95 per cent.                        |
| Stored in airtight concrete silo for 5 years. <sup>(20)</sup>   | 95 per cent.  | 75 „                                |



In so far, then, as the vitamin B<sub>1</sub> content is concerned, storage in straw bags in a granary is possible without serious loss up to about two years; but under such storage it has been found<sup>(14)</sup> that after one year in a straw bag the taste of the rice was undesirable, after two years taste, smell and colour were very bad and the rice could scarcely be eaten, whilst after three years in the straw bags the grain was bad and could not be used. It will be shown later that the development of an undesirable smell and taste affects the treatment required before cooking, and consequently the vitamin B<sub>1</sub> content, so that mere retention of the vitamin during storage is only part of the story.

17. From the evidence we now have, it may be concluded that when no special precautions are taken—or when these are impracticable—rice is best stored in the husk. Where it is possible to store in air-tight containers, this should be done. The rice may then be stored hulled, for, as a result of experiment, it has been shown that when kept under these conditions, in no respect was un-hulled rice superior after storage to the hulled product<sup>(21)</sup>. Even better results are claimed<sup>(14)</sup> when the grain is stored under carbon dioxide. When, as is sometimes the case, fumigants are employed to rid the grain of insects, it is also more convenient to use hulled rice as it is difficult for heat and gases to penetrate the husk. It is of some interest to note that when carbon dioxide is used in combination with fumigants, the toxicity of the latter for the infestation is increased, as carbon dioxide is a respiratory stimulant.

18. Under primitive conditions, with limited material at hand, the best method of attaining completely air-tight storage is still a matter of experiment. There is evidence that successful storage of foodstuffs on a small scale is possible with glazed crocks covered with raw hides. The value of heavily mudded containers is being investigated. Metal tanks have been used<sup>(19)</sup> (1.7 metres high and 0.9 metres diameter) with quick lime to act as a “drier”<sup>(13)</sup> (1 kg. per 30 litres of rice) introduced at intervals in the tanks, relatively more “drier” being placed in the lower parts of the tanks. Good results are claimed<sup>(20)</sup> with concrete silos (capacity of 1.8 kilo-litres, i.e. about 64 cu. ft.; height not more than 3 metres) having walls 15 cms. thick; they must be thoroughly dried out, and care taken to see that they are hermetically sealed. The oxygen in the air introduced with the grain is used up by the latter in the course of respiration; to assist in using up the dead-space oxygen, a lighted candle may be introduced<sup>(29)</sup> immediately before the container is closed.

19. From time to time evidence has been present in support of the view that substances are produced in rice during storage which are toxic to human beings. It has been thought that the toxicity might be due to poisons produced by fungi or bacteria growing on or in the grain. The opaque patches occasionally seen in grains of non-glutinous rice were at one time considered to be the result of changes following the growth of invading organisms. These views are now said<sup>(22)</sup> to have been based on results obtained by a faulty technique. Investigations of the toxicity of rice were originally made in regard to the causation of beri beri; then it was presumed that epidemic dropsy, a disease occurring among rice-eaters and believed to be different from beri beri, was caused by rice toxins. Recently, however, it appears<sup>(23)</sup> that epidemic dropsy may be the result of poisoning from consuming some brands of mustard oils.

20. In a small area of China there is a method of storage in use in which rice after de-husking is milled, mixed with the bran removed and placed in large plaited grass containers of about 200 cu. ft. capacity. Heating is started by a bundle of twigs and green leaves placed in the middle of the mass of grain. The temperature is allowed to rise considerably, and is controlled by ventilation from time to time by means of a basket-work chimney inserted into the store. This “curing” process is allowed to go on for from six to eighteen months, the condition of



the batch being determined at intervals by examination of samples taken out by means of a hollow probe. The product is known as Kashing rice (after the town in and around which the method is practised) or "yellow" rice, on account of the colour of the product. It is greatly appreciated by some for its flavour, and it is believed to have special dietetic properties. We have evidence that there is breakdown of carbohydrates in the process. There is a similar process in use in India<sup>(41)</sup>. As a method of storage over long periods under primitive conditions, especially to "improve" coarse rices, it may prove worthy of trial and investigation.

### The parboiling of rice.

21. A well-known and widely used method of processing rice is called "parboiling". The process consists of soaking rough rice in either cold, warm or hot water in cement or metal tanks. The water is drained off and the rice is placed in metal cylinders, in which there are one or more perforated steam pipes. Steam is blown into the rice until the hulls are opened slightly. The parboiled rice is then removed from the cylinder, thoroughly dried in the sun or by artificial means, and milled.

22. Not only may the soaking process last as long as four days, but more than one change of water may be employed.<sup>(37)</sup> The duration of steaming is usually only ten to twenty minutes. The length of these operations, and the nature of other details in the process such as the use of excess water or several changes of water, are probably of considerable importance in so far as they affect the vitamin B<sub>1</sub> content of the final product. It is believed<sup>(2)</sup> that during soaking and steaming, vitamin B<sub>1</sub> from the germ and pericarp diffuse into the endosperm. When subsequently the outer layers of the grain are removed in milling, some of the vitamin is left behind in the endosperm, which does not contain the vitamin when the whole kernel has not been treated by parboiling or other treatments with a similar effect (e.g. the "josh" method in use in India).

23. In the course of soaking, vitamin B<sub>1</sub> may also diffuse *out* into the water in the tanks; if the water is in excess of that taken up by the grain, and particularly if the water is changed during soaking, losses may be expected to occur. The process is indeed similar to the washing which, as we shall show later, effectively removes the water-soluble vitamin B<sub>1</sub> from the grain. Some recent experiments<sup>(11)</sup>, however, tend to the conclusion that only 12 hours soaking at 60-70 degrees Centigrade are required to give a good product. If this time period were combined with soaking in amounts of water just sufficient to swell the grain, losses of water-soluble food factors would be avoided. It would be an advantage to acidify the water used at this stage, not only because of eliminating foul odours which may arise in the process, but also because it would stabilise vitamin B<sub>1</sub>. It is obviously desirable in preventing loss of vitamin B<sub>1</sub> to avoid the use of changes of water during soaking.

24. The process appears to have been introduced in the first instance in order to facilitate de-husking, for after the treatment the husk swells and splits. The kernel is also toughened, so that checked grains are strengthened and there is a higher percentage of head rice on milling. The pericarp is, however, more difficult to remove in the toughened grain, and some may remain especially after milling by primitive methods; this may be an advantage from a nutritional point of view. In the opinion of some authorities<sup>(32)</sup>, there is still insufficient vitamin supplied in a diet in which parboiled rice is substituted for ordinary white rice. Indeed, beri beri has been known<sup>(40)</sup> to appear in communities eating parboiled rice, probably because the vitamin has been washed out before cooking, though it has been shown<sup>(39)</sup> (table 7) that the vitamin is less easily removed by washing after a preliminary soaking.



25. A number of advantages, then, are evident in the use of parboiled rice. There is, however, a distinctive flavour which develops in the treatment which, whilst highly appreciated by some, is disliked by others. This point should be kept in mind when the introduction of the method is under consideration. It has been claimed that the parboiled product is more sustaining than a similar rice not so treated. From a commercial aspect, too, it is of value as a treatment of rice used in canning, as the grain keeps its shape better after toughening.

**The milling of rice and the nutritive value of the products.**

26. In the preparation of rice for human consumption, the husk and usually some or all of the outer layers of the grain beneath the husk (the pericarp) are removed. The shelled grain is called hulled or de-husked\* rice. The pericarp and more or less of the embryo is taken off by pounding by hand or foot, or with the aid of mills worked by animals, or with power driven mills. Sometimes de-husking and removal of the outer layers is effected in one process. The portion removed is known as rice bran. If the milling is pushed further to obtain a fine product, the outer layers are more completely removed in fine particles known as polishings, and the product is "white rice." The bran and polishings together may be referred to as "rice meal." A final process in milling consists of a further polishing process in which a coating or glaze, usually containing talc, is applied to the rice. This facing is believed to enhance the appearance of the grain, and to protect it from the attacks of insects. Some polishing powders are definitely harmful to the human body if eaten; and they give rise to the need for washing before cooking which, as will be shown below, is a procedure which might be eliminated with advantage to human nutrition. The practice of using polishing powders, however, seems to be falling into disuse, for in 1931<sup>(1)</sup> out of 195 samples of rices imported into Great Britain, only 16 were coated and only 3 of these had more than 0.5 per cent. of powder on them.

27. The chief product of milling is known technically as "head rice"; it consists mainly of whole kernels. Smaller whole kernels and prescribed proportions of broken pieces are found in other fractions known as "second head rice," "brewers' rice" and "screenings." In a sample of "Fortuna," for example, the following yields have been reported<sup>(36)</sup>:—

|                    | <i>Per cent.</i> |     |     |     |     |    |
|--------------------|------------------|-----|-----|-----|-----|----|
| Milled (head) rice | ...              | ... | ... | ... | ... | 57 |
| Second head rice   | ...              | ... | ... | ... | ... | 8  |
| Brewers' rice      | ...              | ... | ... | ... | ... | 2  |
| Screenings         | ...              | ... | ... | ... | ... | 1  |
| Hulls              | ...              | ... | ... | ... | ... | 19 |
| Bran               | ...              | ... | ... | ... | ... | 8  |
| Polishings         | ...              | ... | ... | ... | ... | 3  |
| Dirt and shrinkage | ...              | ... | ... | ... | ... | 2  |

Efforts in the rice trade are naturally directed towards securing a high percentage of head rice of high grades which are determined largely by appearance and soundness of the grain, freedom from foreign matter and not more than a prescribed amount of moisture (usually taken as 14.5 per cent.).

28. There are, however, important nutritional aspects of rice milling which need to be considered. Beriberi is known to be associated with the consumption of large amounts of highly polished rice, and the disease does not develop when lightly or un-milled rice is substituted for the refined cereal. The solution recommended in the past has been that the latter should be replaced by a partially milled rice. It is by no means certain

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\* De-husked rice, which is not further milled, that is it still retains its pericarp, may be referred to as "milled rice," "brown," "red," or "silver skin" rice.

that this is the best way of combating beriberi and, in practice, it is extremely difficult to introduce the necessary measures among peoples already accustomed to eating white rice, or to prevent those eating the "home-pounded" grain from substituting white rice when they can get it.

29. It is indeed physiologically uneconomical to consume un-milled or only very lightly milled rice, as will be seen from the figures<sup>(24)</sup> quoted in the following table:—

TABLE 3.  
*Digestibility and utilisation of rice.*

| Average mean (per cent.) digestibility. |                 |               |       |                       | From 100 grams of rice.             |                    |
|---|-----------------|---------------|-------|-----------------------|-------------------------------------|--------------------|
| Form of rice.                           | Total nitrogen. | Carbohydrate. | Fat.  | Inorganic substances. | Calories. Actual quantity utilised. | Waste (as faeces). |
| White; 100 per cent. polished.          | 85.79           | 99.68         | 86.81 | 90.88                 | 315.99                              | 4.83               |
| 70 per cent. polished                   | 82.99           | 99.59         | 80.51 | 87.30                 | 303.63                              | 6.95               |
| 50 per cent. polished                   | 81.98           | 99.29         | 74.35 | 84.36                 | 283.55                              | 10.19              |
| Unpolished ...                          | 74.86           | 98.61         | 58.27 | 77.98                 | 273.50                              | 19.72              |
| Unpolished rice flour                   | —               | —             | —     | —                     | 282.01                              | 12.00              |

These show that there is an appreciable loss of nitrogenous matter, fat and mineral substances when unpolished rice is eaten in place of white rice. This is due<sup>(30)</sup> to the fact that in the course of digestion, the juices in the alimentary canal must penetrate not only the wells of the cells of the endosperm, which largely remain intact even after cooking, but also in the lightly or unmilled grain they must pass through the cells of the outer layers of the grain, which are particularly difficult to penetrate. It is clear, too, that digestion will be assisted if the grain is broken up by grinding. Starch which is left undigested inside the cells is likely to be liberated in the colon when the walls of the cells are broken down by bacterial action; fermentation of the starch follows, with gas formation giving rise to the condition known as starch or carbohydrate dyspepsia.

30. Against the losses in digestion must be placed those entailed in milling; these are shown in the following table:—

TABLE 4.  
*Composition of rice before and after milling with percentage loss in weight and of constituents* <sup>(24)</sup>.

|  |           | On moisture free basis. |                |                |                    |                 |                           |
|--|-----------|-------------------------|----------------|----------------|--------------------|-----------------|---------------------------|
| Average of 5 samples.                    | Moisture. | Fat.                    | Crude Fibre.   | Ash.           | Protein (N × 6.25) | Carbohydrates.  | Weight per 1,000 kernels. |
| Composition of unmilled rice (brown) ... | 9.26      | Per cent. 2.45          | Per cent. 0.88 | Per cent. 1.22 | Per cent. 8.67     | Per cent. 86.70 | Gms. 20.11                |
| Composition of white rice ...            | 9.37      | 0.37                    | 0.16           | 0.36           | 8.15               | 90.79           | 18.24                     |
| Losses on polishing ...                  | —         | 86.1                    | 83.7           | 73.2           | 14.9               | 5.7             | 9.5                       |



It has been estimated<sup>(24)</sup> that of the annual yield of unpolished rice in the United States (a thousand million pounds), one hundred million pounds are removed in polishing; this is mainly disposed of as feed. This material includes twenty million pounds of fat, twelve and one half million pounds of protein and nine million pounds of mineral substances. More than 50 per cent. of the latter is a combination of phosphorus with calcium, magnesium and sodium, fully 25 per cent. of it being in the form of potassium phosphate.

31. Vitamin B<sub>1</sub> is also removed in the milling process. The extent to which this occurs is seen from the figures<sup>(39)</sup> given in the table below:—

TABLE 5.

| Form of rice.         | Vitamin B <sub>1</sub> content (international units per 500 gms.) |
|-----------------------|---|
| Unmilled ... ..       | 400–500   |
| Lightly milled ... .. | 250–400   |
| White rice ... ..     | 100–200   |

These figures are given for amounts of 500 gms. of rice; this amount will provide about 1,750 calories if it is all absorbed and utilised; it is probably an average figure for consumption for rice eating peoples, though as much as twice this amount may be consumed daily. The values were obtained from work done in the Dutch East Indies, but have been confirmed by another method of assay in the writer's laboratory in China. Their significance for human nutrition can, however, only be appreciated if the requirements of man are known.

32. An exact statement of human needs is not possible without qualification, since a number of conditions associated with increased metabolic activity of the body, such as occurrence of fever, unusual amounts of exertion, high total energy value of the diet and so forth may increase the amount required.<sup>(31)</sup> As a guide it may be taken that an adult man requires a minimum of 300 international units of vitamin B<sub>1</sub> daily; and it is desirable that double this amount be available. Symptoms of hypovitaminosis are likely to occur on diets which contain less than the physiological minimum; an intake of less than 150 units per day is attended by grave risk of the development of beriberi. On a mainly vegetarian diet such as is taken by peoples living principally on rice, 100–150 international units of vitamin B<sub>1</sub> are commonly consumed from sources other than rice. Beriberi may well develop unless vitamin B<sub>1</sub> is contributed in the rice. From the data given above, it is possible that highly polished rice may supply 100–200 units in 500 gms. of rice, i.e. if there is no loss in cooking. This question may now be discussed.

33. There are numerous ways of cooking rice—the ultimate aim in all is, or should be, to produce a thoroughly cooked product which is attractive in appearance and in which each grain is separate. The basis of most methods of cooking is either boiling or steaming, or a combination of both procedures. Sometimes an excess of water is used, and substantial losses are found, especially in mineral salts and vitamin B<sub>1</sub>. A simple method is given below; the product it yields fulfils the requirements laid down. It is necessary to learn by experience, however, the right amount of water to add for different varieties of rice to end up with a “dry” dish.

To one pound of rice placed in the cooking vessel one and a half pints of water are added; a lid is put on, the water is brought to the boil and then allowed to simmer. The time of cooking is twenty minutes; this can be shortened by five minutes if boiling water is used

in the first place. If the rice is left undisturbed it will cook much better. Should the product be too wet it may be stirred up with a wooden spoon, and excess moisture driven off with the vessel over a small fire. Larger quantities than those given will require a longer time to cook.

In this method the water added is taken up completely; consequently there are no losses.

34. It is customary to wash rice thoroughly before cooking. This is done in, say, a running stream or in some three changes of water. At the same time, the cook often rubs the grain vigorously against the side of the basket or container in which it is being washed. There is no doubt that this stage in the preparation of rice is responsible for vital losses of essential food factors. Some indication of this may be obtained by studying the accompanying table:—

TABLE 6.

*Losses entailed in washing white rice with water* <sup>(34)</sup>.

*Loss in washing.*

| White rice (100 per cent. polished with polishing powder). | Total solid matter. | Protein.        | Carbo-hydrate. | Fat.           | Inorganic substances. |
|--|---------------------|-----------------|----------------|----------------|-----------------------|
|  | gms.                | gms.            | gms.           | gms.           | gms.                  |
| 1 kgm. ... ..  | 42·3<br>(4·2%)      | 12·4<br>(15·7%) | 17·8<br>(2·0%) | 2·7<br>(42·6%) | 4·2<br>(73·0%)        |

35. For many years there have been indications that washing rice is an important factor in the outbreak of beriberi. At a conference in Hong Kong in 1912, it was reported that there were two institutions in which the same rice was being eaten. In the one were monks, none of whom had beriberi; in the other, a nunnery, the disease was known to occur. The difference was ascribed to the fact that the monks, being less fastidious than the nuns, omitted to wash their rice, which therefore retained sufficient vitamin B<sub>1</sub> to protect them against the disease.

36. Experimental evidence on which this view of the importance of washing rice is partly based, is produced in the following table:—

TABLE 7.

*Vitamin B<sub>1</sub> in rice of different grades of milling following various treatments.*

*International units of vitamin B<sub>1</sub> in 500 gms. of*

| Treatment of rice.                | Unmilled. | Lightly milled.    | White rice.        |
|-----------------------------------|-----------|--------------------|--------------------|
| Original ... ..                   | 400–500   | 250–400            | 100–200            |
| Washed ... ..                     | 250–300   | 125–200            | Less than 100      |
| Steamed ... ..                    | —         | 250–400            | 100–200            |
| Washed and steamed ...            | About 250 | 75–125             | Less than 100      |
| Soaked and steamed ...            | —         | 200–250            | —                  |
| Soaked, washed and steamed ... .. | —         | 125–200            | —                  |
| Boiled and steamed ...            | —         | 250–400            | 100–125            |
| Washed for a long time            | —         | Much less than 100 | Much less than 100 |

The figures in this table are of profound importance, and will repay careful study. It will be seen, for example, that after thorough washing both lightly and highly milled examples of rice are almost completely depleted



of their vitamin B<sub>1</sub>. Again the findings were reported from Java<sup>(39)</sup>, and have been confirmed by the writer. Further than this, a feeding experiment has been carried out on groups of factory workers in Shanghai. One group of workers was fed on rice freshly and highly milled each day, and cooked by the method described above, without preliminary washing. Control groups were observed fed on rice milled to a similar degree, but washed thoroughly in the ordinary way. Side dishes and other conditions were comparable in all the groups. No signs of beriberi developed in the group on the unwashed rice, whereas in the control groups nearly half the subjects developed signs attributable to vitamin B<sub>1</sub> deficiency. The rice used in this experiment was actually stored in bags in the husk, as no facilities were available for storage in airtight containers; but the evidence presented above suggests that this would have been a more satisfactory way of conserving the vitamin B<sub>1</sub>. It may then be claimed, on the grounds of these results and on the basis of what we now know of the requirements of vitamin B<sub>1</sub> and of its behaviour in rice under storage, processing and cooking, that—under properly controlled conditions—it is possible to feed highly milled rice without special provision of foodstuffs rich in vitamin B<sub>1</sub> in the diet, and yet avoid the development of beri-beri even in its earliest clinically-recognisable forms.

37. When it is recalled that better utilisation of rice follows powdering (see para. 29 and table 3), especially when some of the outer layers still remain, it is worth while drawing attention to the various methods of cooking rice flour. These include various types of vermicelli, some of which are especially nutritious when egg, fish and other products are incorporated in them, and biscuits or rusks.

38. One other preparation which is not widely known has properties which justify a short description. This is a rice "bread" prepared<sup>(26)</sup> by the Annamites of French Indo-China, and known to them as "banh-duc". Rice is softened by soaking overnight, and is ground to a paste with five times the amount of lime water (containing about 1.25 gm. of lime per litre of water). It is cooked over a low fire for about thirty minutes, when it turns into a pasty mass. This is beaten on a wooden platter, and 1 per cent. of sea salt is mixed into the mass, which is then allowed to cool into loaves of rice bread. The final product is rich in calcium; roughly thirty times as much calcium is ingested when rice is prepared in this form compared with the amount supplied in the same quantity of rice cooked by ordinary methods.

#### Main conclusions.

39.—(i) It is possible to feed rice, which has been well-milled, as a sole staple food without the development of any signs of beriberi provided:—

(a) the rice is stored under conditions such that its vitamin B<sub>1</sub> is not lost;

(b) it is not washed before cooking;

(c) there is no superfluous water at the completion of cooking;

(d) not less than 150 international units of vitamin B<sub>1</sub> are supplied daily in other components of the diet.\*

(ii) Storage of rice is a crucial factor in adequate nutrition with respect to vitamin B<sub>1</sub> amongst rice-eating peoples. It has been established that rice can be stored without its husk with as good if not better results than those obtained with rice stored with its husk on. To succeed with the former method, however, there must be control of the moisture content of the grain, and it must be kept in airtight containers, or, better still, in an

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\* This amount is usually found in diets in which rice is the staple cereal; it is provided, for example, in 6 oz. of dried beans or 3 oz. of ground nuts.

atmosphere of carbon dioxide. Storage without the husk has great advantages in bulk storage or where the article has to be transported, since the removal of the husk results in a considerable reduction in both weight and volume. Incidentally, the rice bran will be, nutritionally, a far more valuable product if it is used immediately after removal from the grain.

(iii) Washing of rice before cooking may drastically reduce the beri beri-preventing factor; this is true for rice of all grades of milling. The need for washing can be eliminated:—

(a) if polishing powders are abolished—they appear to serve no useful purpose, and must be washed off as they may be definitely harmful if eaten;

(b) if the storage is so good that the grain does not develop an undesirable flavour—storage of de-husked grain in hermetically sealed containers meets this requirement;

(c) if milling is carried out shortly before the rice is required for consumption—milling is itself a cleansing process, and if the product is subsequently handled hygienically, further cleaning would be superfluous.

(iv) Cooking must be carried out in a manner in which there is retention of vitamin B<sub>1</sub>.

(v) Parboiling affords a partial solution of the problem of conservation of sufficient vitamin B<sub>1</sub> to prevent the occurrence of beriberi. It may not be acceptable, however, if there are definite prejudices against the flavour of parboiled rice. In the process there are steps in which losses of the vitamin may occur; these can be reduced by modifications based on the knowledge that *vitamin B<sub>1</sub> is soluble in water*, and is more stable in slightly acid than in alkaline solutions. No advantage is gained by substituting parboiled for other rices if it is washed before cooking, as the vitamin B<sub>1</sub> is then reduced to levels at which beriberi develops.

(vi) The yield of rice attained in Far Eastern countries contrasts markedly with that in many Colonial Territories. This is a matter for Agricultural Departments to take up; it involves mainly the provision of irrigation works, the control of seed selection, weeds, and harvesting and the maintenance of soil fertility.

(vii) Large tracts of undeveloped land are to be seen in some Colonial Territories which, under proper irrigation, should provide suitable ground for rice cultivation.

(viii) Whilst there are differences in variety and cultural conditions which, to some extent, modify the nutritional value of rice, increased yield per unit area should be the first consideration. When conditions permit of optimal production, there is no food crop of comparable nutritional value which can approach rice in the amount of food produced on a given area. Moreover, it has a valuable sociological feature; it anchors a community to the place in which it has expended capital in the form of irrigation works, including terraces, conduits, bunds, pumping and other devices for water conservation and control.

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Economic Advisory Council

Committee on Nutrition in the Colonial Empire

FIRST REPORT—PART II

SUMMARY OF INFORMATION  
REGARDING NUTRITION IN  
THE COLONIAL EMPIRE

*With Special Reference to the Replies received to the  
Circular Despatch from the Secretary of State  
for the Colonies, dated 18th April, 1936*

*Presented to Parliament by Command of His Majesty,  
July, 1939*



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*GREAT BRITAIN*  
Economic Advisory Council

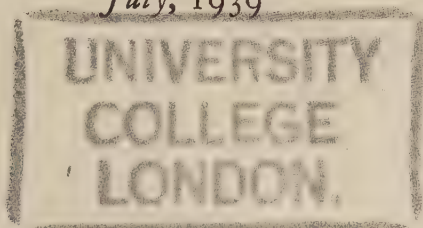
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NOTE.—The prices given do not include postage.

Arrangements are also being made for the publication of the report from Somaliland. Copies will be obtainable from the Crown Agents for the Colonies, but the price is not yet fixed.



## FOREWORD.

The following summary of information relating to nutrition in the Colonial Empire has been prepared chiefly from the replies received to the circular despatch from the Secretary of State for the Colonies of the 18th April, 1936. It also incorporates additional information available from other sources.

It should be emphasised that the statistics of birth and death rates and infant mortality cannot in the great majority of cases be regarded as accurate. The figures given often relate only to a small part of the territory in question which may be in no way a true sample of the whole. Moreover these figures may not be complete even in regard to the area to which they relate. There is, for instance, in most cases no compulsory registration of births or deaths, and it is quite possible that a larger proportion of births than of deaths go unrecorded. It has, however, been thought desirable to include these figures as furnishing the only information at present available on these subjects.

## MEDITERRANEAN.

### CYPRUS.

*Area:* 3,584 sq. miles.

*Population.* 367,216 (1936).

*Birth Rate:* 34·3 per 1,000  
(1936).

*Infant Mortality:* 105·2 per  
1,000 births (1936).

*Death Rate:* 12·4 per 1,000  
(1936).

1. *General.*—The Cypriot is tenacious of his food habits and is suspicious of change. Attempts to induce voluntary improvements by propaganda are likely to be slowly rewarded.

2. *Composition and Nutritive Value of Dietary.*—The home-grown food of the Cypriots consists of bread, olives, legumes, green vegetables, fruit, cheese, milk, with eggs and meat occasionally. The well-equipped dairies in the chief town practise hygiene and furnish good supplies of cows' milk.

Country districts rely entirely on the milk of sheep and goats, most of which is converted into cheese, or into "yoghourt", a sour milk preparation. Condensed milk is imported to the annual value of about £6,000.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Rickets, scurvy, beriberi and pellagra are non-existent. But quantitative deficiencies in the food of children of the poorer classes have long been recognised to exist. A considerable number of the rural population are, on account of poverty, definitely underfed and thus liable to tuberculosis, colds, infectious diseases and epidemic ophthalmia, the incidence of all of which is high, especially among the underfed. There is a rather heavy incidence of cancer, diabetes, anaemia, enteritis, nephritis, and gastric and duodenal ulcer.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The main cause of dietary deficiency, both in town and country, is poverty. The immediate problem is how to remedy the quantitative deficiencies.

5. *Researches and Surveys.*—No major investigations have hitherto been undertaken. A number of papers on the nutritive value of local foods have been published.

The study of diets, in relation to health and disease, in various social classes and racial groups is recommended as advisable.

6. *Practical Measures for Improvement of Nutrition.*—In the principal towns and a few of the larger villages free midday meals for the poorer elementary school children are provided by municipal grants and private charity with assistance from Government educational funds. Communal soup kitchens are



established in Limassol and are contemplated in Nicosia. Attempts to improve conditions are being made by a certain number of health clinics, child welfare centres, day nurseries, and by an Anti-Tuberculosis League. An important scheme for rural development with special reference to agriculture and health is now being inaugurated.

### GIBRALTAR.

|                            |        |  |
|----------------------------|--------|--|
| <i>Area</i> : 2 sq. miles. |        | <i>Birth Rate</i> : 19.3 per 1,000 (1936).               |
| <i>Population</i> (1935).  |        | <i>Infant Mortality</i> : 62.09 per 1,000 births (1936). |
| British subjects ...       | 16,875 | <i>Death Rate</i> : 15.47 per 1,000 (1936).              |
| Aliens ...                 | 2,319  |  |
| Total ...                  | 19,194 |  |

1. *General*.—Since in this small and peculiarly situated Colony, the problems of nutrition do not arouse the same immediate concern as in other parts of the Empire, no local Nutrition Committee is, at present, thought necessary.

2. *Composition and Nutritive Value of Dietary*.—Gibraltar depends on imported foodstuffs, obtained in part by sea and in part from Spain. The food supply is good, varied and very largely fresh. Little evidence exists to the effect that the dietary is other than adequate. Grossly underfed children are seen only very occasionally, and these are invariably confined to the poorest class.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Rickets, scurvy, pellagra and goitre are practically unknown. The infant mortality rate has been falling steadily for the past 20 years and at present stands at 62 per 1,000 births. There is a high incidence of pulmonary tuberculosis.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—Having virtually no agriculture, and producing locally only a fraction of the milk and fish consumed, Gibraltar depends on imported food substances, which come in freely and without tariff. There is no famine problem in the Colony and the few cases of undernourishment are attributed solely to poverty.

5. *Researches and Surveys*.—Whether the high incidence of pulmonary tuberculosis is connected with nutritional deficiency is at present being investigated.

6. *Practical Measures for Improvement of Nutrition*.—Necessitous cases are provided with free milk and meals through the agency of a pre-natal clinic, infant welfare centre and a soup kitchen. It is recorded that necessitous school children

(usually about 600) who are given a free midday meal during the winter months, work better after the meal than during the morning. The Governor hopes to establish a sanatorium for the treatment of tuberculosis.

### MALTA.

*Area*: 121 sq. miles.

*Population*: 262,165 (1936).

*Birth Rate*: 33·86 per 1,000 (1936).

*Infant Mortality*: 190·30 per 1,000 births (1936).

*Death Rate*: 17·61 per 1,000 (1936).

1. *General*.—A Committee, consisting of representatives of the Departments of Health, Agriculture, Customs, and Education, has been appointed to survey the position. This Committee has submitted a locally printed report.

2. *Composition and Nutritive Value of Dietary*.—The staple articles of food belong to the energy giving groups, *i.e.*, carbohydrates and fats (bread, paste, margarine, oil) while the protective foods (milk, butter, eggs, meat, fruit, vegetables) enter but sparingly into the diet of average working-class families who have to rely on the cheaper articles of food to satisfy their hunger. Certain surveys, particulars of which are given in detail, show that the diet of a large section of the population is improperly balanced, containing excessive carbohydrate and lacking animal protein and fats, mineral salts and vitamins. It was found that 26 per cent. of school children drink no milk, while 54 per cent. drink less than 4 oz., and 20 per cent. little more than 4 oz. daily. Among working-class families examined, 76 per cent. consumed no butter and 60 per cent. no fruit. The Committee were much impressed by the inadequate consumption of milk especially by expectant and nursing mothers and young children. The chief source of supply of milk is the goat.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Despite the dietary imperfections referred to above, it would appear that gross malnutrition is not a common feature in Malta. Cases of starvation are rarely met with. Nevertheless, signs of undernourishment are not infrequent owing to casual employment and the low wages prevailing among a large section of the population. Malnutrition is also found among expectant and nursing mothers especially among those who bear offspring in quick succession, as is very common in these Islands. Cases of obvious malnutrition among school children are estimated at about 5 per cent. and occur mostly in town bred children. Insufficient feeding is one of the factors leading to impaired physical development. Deaths from rickets and anaemia during the past 10 years have fallen from 21 and 71 respectively in 1926 to 2 and 9 in 1936.



In some respects conditions are unique, inasmuch as Malta is one of the most densely populated of European countries, having a population of 2,434 (1935) per sq. mile as compared with 685 (1935) per sq. mile in England and Wales. The birth rate per 1,000 total population averaged 33.48 in the years 1921-31. In 1936 it rose slightly to 33.85. This rate is abnormally high in comparison with that of other European countries [Cf. England and Wales, 14.7 (1935); Italy, 23.3 (1935); Germany, 18.9 (1935)]. Malta's infant mortality rate is also abnormally high. In 1935 it was 285.71 per 1,000 births.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—As to the economic side of the question, there is no doubt that poverty has a direct influence on the dietary of the people. The main causes of such malnutrition as exists are the low wages earned by a large section of the population coupled with ignorance regarding diet which aggravates the ill consequences of low purchasing power. Family budget studies revealed that out of an average weekly family expenditure on food of 18s. 2½d. in a household of five persons, 8s. 3d. was spent on bread and potatoes, 7s. 9d. on milk, meat, eggs, fish, fruit, vegetables, butter and cheese, and 2s. 2½d. on wine, coffee and tea. As has been observed in other countries, these studies showed that improved dietary goes hand in hand with rising income. It has been impossible to calculate the *per caput* consumption of foodstuffs, but from data given on the total quantities of locally produced and imported foodstuffs available for consumption, it is evident that the total consumption of some of the more important health foods has shown a marked increase during the past 10 years.

5. *Researches and Surveys.*—Until the Committee reviewed the position, no nutrition studies had ever been undertaken. On their appointment, however, the Committee instigated certain inquiries the results of which form the basis of their report. These studies, which are recorded in considerable detail, include data on the composition of the diet of working-class families in various villages and towns, and particulars of 100 family budgets collected by the Labour Department and 18 others from H.M. Dockyard. The local Committee recommends that these surveys be extended in order to acquire data on the food consumption of families at different income levels and on the distribution of the population by family incomes. Surveys should also be undertaken in various districts to ascertain the extent of physical defects among school children attributable to faulty diet.

6. *Practical Measures for Improvement of Nutrition.*—With a view to improving nutrition Government support is already being given in the following directions:—Mother and child welfare organisations; district nursing; the feeding of necessitous

children; supervision of hospital and orphan asylum dietaries; and the administration of various regulations designed to safeguard the quality of food supplies. Further measures recommended as desirable are extension of the mother and child welfare services; extended supply of free milk to school children; intensified efforts to promote an increased consumption of fish by preventing inflation of prices by retailers; and the dissemination of information on nutrition by means of lectures, leaflets, posters and educational films. A Government Milk Centre has recently been started to provide pasteurised goats' milk for the general public and for Government charitable institutions and schools.

### PALESTINE.

*Area:* 10,000 sq. miles.

*Population* (1937).

|            |     |         |
|------------|-----|---------|
| Moslems    | ... | 809,394 |
| Jews       | ... | 386,084 |
| Christians | ... | 109,769 |
| Others     | ... | 11,520  |

Total ... 1,316,767

*Birth Rate:* 41.58 per 1,000 (1937).

*Infant Mortality:* 152.84 per 1,000 births (1937).

*Death Rate:* 18.90 per 1,000 (1937).

[*Note.*—No separate report has been received from Transjordan, but such information as is available in regard to Transjordan is incorporated in this section. No specific study of the problem has been undertaken since MacLennan visited the country in 1935. In the opinion of the Director of Public Health, however, the nutrition of the rural population has, generally speaking, improved since that date.]

1. *General.*—No local Nutrition Committee has been formed. In the absence of even a preliminary survey of the position, it is considered that a Committee would not be in possession of adequate information to enable it to formulate a nutrition policy applicable to a fluctuating and diversified population such as exists in Palestine. The only relevant information which exists is that furnished by the limited surveys of Kligler in Palestine, and of MacLennan in Transjordan; which are summarised in paragraph 2.

2. *Composition and Nutritive Value of Dietary.*

### JEWS.

*Urban* (Kligler): *European section* (*Ashkenazic; occidental*).—Live on a better scale than Oriental section. Eat more meat, milk and butter. Consume an average of 2,500 calories daily.

*Urban* (Kligler): *Oriental section.*—Eat more vegetables than European section. Consume an average of 2,300 calories daily.



*Rural* (Kligler): *Colonists*.—Consume more than the two Urban groups studied, *viz.* about 3,500 calories daily. Diet of children is richer in fat than that of adults, has an excessive energy value and a faulty Ca/P ratio.

#### ARABS.

*Urban*.—No data.

*Rural* (Kligler): *Fellahin* (*agricultural villagers*).—Two villages surveyed. Consume less milk and less meat, but more vegetables than Bedouins. Freely consume olive oil. The high fat and relative excess of phosphorus are unsatisfactory features of the diet.

*Rural* (Kligler): *Bedouins* (*semi-agricultural*).—Two camps surveyed. Consume more milk and more meat, but less vegetables than Fellahin. Use butter oil rather than olive oil.

*Rural* (MacLennan): *Bedouins* (*semi-agricultural*).—Four tribes examined. MacLennan says Kligler's limited survey does not represent a true picture for the general Arab rural population. The tribes MacLennan examined were very poor, existing on a diet inadequate in both quantity and quality, and, during certain seasons, often consisting exclusively of unleavened bread (khabs) and olives. Milk was available only to those possessing goats or camels; meat was a luxury, and the only other supplementary foods were small quantities of grapes, figs, dates and melons, eaten mostly by richer families. In short, the value of the food supply is considerably less than as recorded by Kligler. Calcium is deficient and protein is almost solely of vegetable origin. The supply of vitamins A, B, and C is uncertain, and vitamin D, contained chiefly in Arab butter (semneh), is available only for about three to four months of the year.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—The rural Jewish, and a large part of the urban Jewish population, are very well nourished. The extent of undernourishment among the Bedouin and Fellahin is unknown, but it is held to be serious among the former class. Infant mortality is high. For the population as a whole the rate is 152.84, but it is particularly low in the Jewish section, 57.20. The highest rate is found in the Moslem group of the community, 179.31. Cases of scurvy and pellagra are occasionally encountered, but are not common. Rickets is uncommon, but marasmus and debility amongst infants in the Arab population is prevalent. Dental caries is not unduly high, and in the Arab rural population is low. In medical examination of 30,000 Arab school children in 1937, 306 were found with four or more teeth badly decayed, the incidence being higher in the town schools. From statistics published by the Straus Health Centre, of 2,000 Jewish school children in

Jerusalem examined at the school dental clinic for the first time, 19 per cent. had sound mouths. Xerophthalmia occurs in the Arab population, 12 cases being found in 21,000 patients examined at the Ophthalmic Hospital of the Order of St. John in 1935. Pneumonia is common. In statistics of deaths of which about one-third of the total notified can be classified as to cause, pneumonia accounts for about 18 per cent.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—As is the case in other countries, the economic status of the individual is the factor which determines good or bad nutrition in Palestine. Among the poorest class, 70 to 80 per cent. of the income is spent on food. The quantity and quality of diets in rural areas is inferior during the winter months.

All requirements for a normal and nutritious diet are capable of production in the country. Local production, however, has to be supplemented by considerable imports of butter, condensed milk, eggs, poultry, meat, fish, vegetables, flour, rice, etc.

The Government, through the department of Agriculture and Fisheries, has devoted much attention and labour to assisting the local agriculturist in improving the quantity and quality of his produce. There are two Government directed and nine non-official agricultural schools. Dairy farming, vegetable production, the home canning of vegetables and fruit are taught in addition to general agriculture and fruit production. The improvement of stock, both for milk production and the meat market, has engaged much attention and valuable results are being obtained by the loan of selected stock males for breeding purposes and the castration of scrub male stock. Modern poultry farming has made great strides, assisted by supplies of eggs and stock of suitable breeds from Government poultry stations. The cultivation of potatoes has been introduced and has developed very successfully. The Government assisted the establishment of the industry by importing seed-potatoes for sale to growers at cost price. The growing of forage crops has been stimulated and greatly extended. Citrus cultivation has made great strides and, in addition to a large and growing export trade, adequate supplies are available at low prices for local consumption in season. There is a growing production of bottled citrus juices. The local consumption of fruit and citrus juices is encouraged by propaganda conducted by the Government citrus fruit advertising committee. The veterinary services provide for the *ante* and *post mortem* examination of all animals slaughtered in municipal and local council areas for food. A fisheries protection and development service has been established with consequent improvement of quantities and size of fish caught locally for the market. An Agricultural Council composed of official and non-official members acts in an advisory



capacity to the Government. Committees deal with individual problems such as questions affecting the economics and marketing of agricultural produce.

Education and propaganda are conducted. An agricultural supplement to the Official Gazette is published monthly in which the results of local experiment and research are brought to the notice of the public. Talks in Arabic and Hebrew are a regular weekly feature of the local broadcast programmes.

The monthly expenditure of an average urban family of 4.2 man units on 20 staple food commodities (including fuel) is approximately £P.5. This estimate does not, however, apply to lower Arab labouring classes whose expenditure is probably much less as the total monthly earnings of an unskilled labourer approximate £P.3-£P.4. There has been a very considerable reduction in the retail cost of certain valuable food commodities in the last 18 years as gauged by published statistics, e.g. fresh milk, mutton, potatoes and rice 50 per cent., eggs and fish 40 per cent., butter 30 per cent., beef 25 per cent. A full third class Arab diet in Government hospitals, including extras, costs approximately 40 mils\* per diem, and the very complete prison diet (hard labour), 3,200 available calories including all essentials, averages 22 mils per diem at present contract prices.

5. *Researches and Surveys*.—The only surveys hitherto undertaken are those of Kligler and of MacLennan summarised above. With regard to the improvement of nutrition, the local authorities conclude that little of importance can be achieved until a comprehensive scientific investigation has been made into the whole position.

6. *Practical Measures for Improvement of Nutrition*.—Reference has been made in paragraph 4 to the work undertaken by the Department of Agriculture and Fisheries for the improvement of local produce in quality and quantity, and of animal husbandry.

Instruction and education are necessary to produce a proper appreciation of the value and importance of diets. The infant welfare services of the country are performing valuable work in this direction. The Jewish community is particularly well served by Jewish organisations, but there is room for considerable expansion of this work amongst Arabs. There are 37 Jewish infant welfare centres for a population of 386,084; and 36 Government and three private centres which attend to the infants of the rest of the population numbering 930,683. At all centres attention is given to instruction of mothers in the diet of infants and children. In the education of elder girls and teachers the Department of Education lays stress on domestic science, and there is an annual competition open to Government schools for

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\* 1,000 mils = £P.1 = one pound sterling.

a Domestic Science Shield. The senior girls in Government schools are given instruction in mothercraft in infant welfare centres of the Department of Health. A rural training centre has been established by Government for women teachers from villages where they are given practical training in domestic subjects with special reference to the needs and environment of the village girl.

Jewish organizations maintain several schools for training girls in agriculture and domestic science, and two mothercraft training centres. The Nathan Straus Health Centre at Jerusalem carries on health education and propaganda amongst Jews. The subject of nutrition and economic diets receives adequate attention.

Radio talks in Arabic and Hebrew from the Government broadcasting station on health matters deal, from time to time, with the subject of diets and nutrition.

The public is protected from adulteration and falsification of foodstuffs by the service of inspection and sampling carried out by the Department of Health under the Public Health (Rules as to Food) Ordinance. Rules under the Ordinance deal with standards of foodstuffs, the use of preservatives, labelling, and the procedure of sampling.



## AFRICA.

## EAST AFRICA.

WORK OF THE STANDING MEDICAL RESEARCH COMMITTEE,  
COVERING EAST AFRICAN TERRITORIES.

There is general agreement amongst all the Nutrition Committees set up in East African territories that the opinions of technically untrained observers should be supplemented by scientific investigation.

With the exception of Aden and British Somaliland, which looks to the Anglo-Egyptian Sudan for co-operation in nutritional problems of a similar nature, all the East African dependencies look to the Standing Medical Research Committee for East Africa to prosecute inquiries, to direct and co-ordinate field studies into conditions of village life, food taboos, dietary prejudices, to initiate medical surveys of nutritionally poor districts and to make comparative dental studies regarding the incidence of carious teeth. The Uganda Committee wish the methods of native cookery best suited to the preservation of the nutritive value of food to be elicited. In Nyasaland a comprehensive dietary survey is now being undertaken in co-operation with the Medical Research Council and the International Institute of African Languages and Cultures. Details of the survey are given in Part I of this Report (paragraphs 403 to 405).

All are appreciative of the work done in investigating the basic metabolic rate and energy exchange of the native and are anxious that the laboratory work in this connection carried out in Nairobi should be extended, and that inquiries into the chemical composition and nutritive value of local foodstuffs, including adventitious dietary "extras," should be prosecuted.

## BRITISH SOMALILAND.

|                                     |                           |                            |
|-------------------------------------|---------------------------|----------------------------|
| <i>Area</i> : 68,000 sq. miles.     | <i>Birth Rate</i> :       | } No statistics available. |
| <i>Population</i> : 344,700 (1931). | <i>Infant Mortality</i> : |                            |
|                                     | <i>Death Rate</i> :       |                            |

1. *General*.—The specially appointed local Committee has drawn up a 37 page report, in which it recommends, *inter alia*, that a Standing Committee on Nutrition be established.

2. *Composition and Nutritive Value of Dietary*.—The natural food of the nomad Somali is milk and meat with such additions as ghee, dates, rice, sugar, tea and salt as he can procure. The one essential to his health and happiness is milk—camel's milk for direct consumption and that of cow, sheep and goat for the preparation of ghee. The individual capacity for milk

among nomad tribes reaches 10 pints or more a day. It is not uncommon for a party of nomads to touch nothing but camel's milk over a period of several months.

In towns, rice, dates and ghee come first, with milk and meat as secondary foods. This is the standard ration of Government employees (Police and Camel Corps) who, as a result of the regularity and quantitative adequacy of the dietary provided, show great physical superiority over poorer town natives for whom uncertainty of supply is frequent and may occasionally result in individuals being without food for 24 hours or more at a time. A typical average dietary, quantitatively sufficient, does not appear to have any serious qualitative defects beyond lack of variety and imbalance due to fat excess resulting from the popularity of milk and ghee. Noteworthy is the almost complete neglect of green vegetables and a genuine contempt for fish and eggs. Dietary improvements indicated are the popularisation of fresh vegetables, an increased consumption of locally produced "jowari" (millet) and a diminished consumption of rice of low nutritive value.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—In considering the nutritional status of the Somalis prominence must be given to their distinctive racial characteristics in stature and physique. With lean, wiry bodies and light skeletal frames they are equipped by nature, not for manual labour which they dislike, but for a specialised type of nomadic existence requiring tremendous powers of endurance in times of privation and the ability to cover great distances daily, mounted or on foot. An adult male of six feet weighs between  $8\frac{1}{2}$  and  $9\frac{1}{2}$  stone. This racial characteristic of leanness can by no means be accepted as a positive and invariable indication of malnutrition. Interesting weight data show that although a Somali prisoner may at first gain in weight on the regulation prison diet, the improvement is difficult to maintain in long-term prisoners owing to the psychological effect of incarceration and the unaccustomed diet which, though adequate by usual standards, deprives him of his natural food which is undoubtedly milk. A further important point is that unlike his Bantu prototype in East or Central Africa the Somali does not have to compete with a massive infection of intestinal parasites. Round, hook and tapeworms are not indigenous, and a locally acquired infection is never found. Neither is malaria a force of any great influence on the physical standard of the Somali.

With a striking dietary deficiency of fresh fruit and vegetables, the negligible incidence of rickets, pellagra, scurvy, beriberi and xerophthalmia is especially noteworthy. As a result of investigations made during certain military operations during which scurvy caused considerable concern it was conclusively proved



that camel's milk is not only protective against the disease but a curative as potent as, if not more so than, lime juice or fresh vegetables. For native Somalis no remedy acts more rapidly than camel's milk. Xerophthalmia has not been reported, an indication that vitamin A supply is adequate. Clinical evidence points to a possible deficiency of iodine. Constipation is universal, as is only natural in a country where the fluid intake other than milk is minimal. The only disease closely allied in type to conditions arising from avitaminosis, mineral deficiency or both, is that described by Buchanan under its local name of "Chachaleh." The chief symptoms of the condition, which simulates beriberi and is commonly met with both in township and jungle, are aching muscles, bones and joints, epigastric pain, oedema, and "burning feet." It has been reported that in the Nogal Valley\* there is no sign of undernutrition, deficiency diseases being unknown. It would be interesting to know more regarding the precise nutritional quality of the diet in this area.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—All rice, dates, flour, sugar and tea consumed in the Protectorate are imported. (a) *Milk*.—During certain seasons of the year there is an abundance of milk in the remoter areas which cannot be consumed and for which there is no market in the producing area, whereas the town dweller is often unable to obtain it at all. A tentative scheme is outlined whereby, with the increased use of motor transport, it is considered that this surplus milk could be effectively and economically transferred from country areas to towns. The Governor is prepared to give the scheme a trial if the necessary funds are forthcoming to subsidise it in its initial experimental stages. (b) *Fruit and Vegetables*.—These are scarce, although certain quantities are obtainable from Aden. In order to increase consumption, the reviewing Committee recommends that vegetables should be relieved of customs duties; and also that the existing market dues on such grains (e.g., jowari) as are likely to become popular food should be reduced or removed. The revenue from these duties amounts to about £800 per annum. (c) *Animal Husbandry*.—Somaliland depends for its livelihood on its livestock, not only as direct food supply, but as its main source of income. The extension of rotational grazing will be encouraged with a view to obtaining a better yield and quality of milk in the areas adjacent to townships. In pasture management and the breeding of livestock the outstanding difficulty is the shortage of water. Steps are being taken to increase the number of watering posts and to make additions to the sources of water supply by the sinking of deep bores. Experience has already shown that when water has been made available in, or near,

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\* *Nutrition Research in the British Colonial Empire*.—Imperial Bureau of Animal Nutrition, Tech. Communication No. 8, 1937, p. 16.

dry season grazing areas, camel's milk, ghee and mutton have become more plentiful and the physical condition of the tribes has correspondingly improved.

5. *Researches and Surveys*.—Hitherto very little has been done beyond the researches of Buchanan referred to above. At present there are small laboratories attached to the Medical and Veterinary Departments. The Committee recommend as highly advantageous a direct and intimate research co-operation with the Anglo-Egyptian Sudan which faces nutritional problems of a similar nature.

6. *Practical Measures for Improvement of Nutrition*.—The Committee strongly recommends the establishment of a Maternity and Child Welfare Centre. See also under paragraph 4 above.

### KENYA.

|                                  |     |           |                           |  |
|----------------------------------|-----|-----------|---------------------------|--|
| <i>Area</i> : 224,960 sq. miles. |     |           | <i>Birth Rate</i> :       | } No<br>reliable<br>statistics<br>available. |
| <i>Population</i> (1936).        |     |           | <i>Infant Mortality</i> : |  |
|                                  |     |           | <i>Death Rate</i> :       |  |
| Europeans                        | ... | 18,269    |                           |  |
| Asiatics                         | ... | 54,690    |                           |  |
| Natives                          | ... | 3,186,976 |                           |  |
| Others                           | ... | 1,587     |                           |  |
| <hr/>                            |     |           |                           |  |
| Total                            | ... | 3,261,522 |                           |  |

1. *General*.—No special Committee has been appointed. The opinion is expressed that the necessary co-operation in nutrition work between the Administration, Agricultural, Veterinary and Medical Departments can be secured without the appointment of a local Nutrition Committee. In the memorandum forwarded by the Kenya Government, it is emphasised that the knowledge already gained regarding the nutrition of Kenya natives is very considerable and that, indeed, research has tended in recent years to move ahead of agricultural practice and policy. The report submitted from Kenya deals chiefly with the necessity for reflecting in agricultural policy the knowledge of nutrition already available, second place being given to the medical and research outlook on the subject.

2. *Composition and Nutritive Value of Dietary*.—[For a summary of the numerous published papers on Kenya dietetics reference may be made to *Nutrition Research in the British Colonial Empire*, Imperial Bureau of Animal Nutrition, Tech. Communication No. 8, 1937, pp. 6-10. Price 1s.].

The diet of the native in the reserves is varied in quantity, although in some respects qualitatively deficient. Different tribes have entirely different dietary habits. For example, the diet of



the Masai consists chiefly of meat, blood and milk, whilst that of the Kikuyu, and, indeed, of most other tribes in Kenya, is mainly composed of cereals (maize), tubers and legumes. The chemical composition of local foodstuffs has been extensively studied, analytical data being available in a number of publications. On the whole it is true to say that the food supply available for the native population is adequate in total, and that any deficiency results from maldistribution, poverty and ignorance.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—In the well-known study by Orr and Gilks, medical examination proved beyond dispute the great superiority in weight, stature and fitness of the milk-nourished and carnivorous Masai to the vegetarian Kikuyu. The Kikuyu diet was as a whole found to be deficient in calcium and sodium, elements which, in the case of women, were made good by the eating of leaves rich in these minerals. Marked differences were also noticed in the incidence of disease in the two tribes. Common among Kikuyu were bony deformities, dental caries, anaemia, pulmonary conditions and tropical ulcer. The diseases of the Masai were of a different type, rheumatoid arthritis being common and possibly related to their high meat consumption.

Despite the improvements made in institutional diets, and the care taken to ensure that these are adequate, sporadic cases of deficiency diseases (*e.g.* Rand scurvy) occasionally occur. The incidence of night blindness and xerophthalmia among prisoners and of pneumonia, tuberculosis and ulcers in the free population suggests a general vitamin A deficiency. There is probably no deficiency of vitamin D. Other observations suggest a possible iron deficiency.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—As indicated in paragraph 1, local authority is concentrating on bringing native agricultural practice into harmony with the nutritional needs of the people. The opening up of markets and the organisation of trade between agricultural and pastoral tribes has led to a better distribution of foodstuffs than existed, say, 10 years ago, with a consequent improvement in the dietary of the people on the land. (See paragraph 6.) With the object of increasing the native consumption of local foodstuffs (meat, etc.) agricultural policy has a two-fold concern (*a*) to increase cultivation of food crops in the agricultural areas and to improve their variety and quality, and (*b*) to improve animal husbandry in all areas both agricultural and pastoral. In regard to the former some appropriate system of permanent rotation is aimed at, the greatest difficulty so far encountered being the unwillingness of the natives to grow a leguminous green manure crop for the purpose of turning under

to assist maintenance of fertility. The planting of Napier grass will be helpful for this purpose and a similar effect is claimed for the wattle tree in the case of worn-out cultivated lands in certain areas. As regards pastoral areas, the presence of disease and the lack of markets in the past for meat and livestock generally have hampered development, but it is hoped by intensifying sound grassland management and encouraging modern breeding methods to effect improvements which will provide greater returns from stock products and eventually result in a general raising of the standard of living among stock-owning natives.

5. *Researches and Surveys*.—[See also Note on the work of the Standing Medical Research Committee for East Africa, p. 10 above.] No recommendations are made for extension in the present research programme being carried out in the Medical Laboratory at Nairobi. This is mainly concerned with studies on the basal metabolic rate of and energy exchange in the East African native, which are locally regarded as of importance in order to find out whether or not the results of nutritional investigations under European conditions can be applied without modification in Africa. There has recently been completed a long term rat-feeding experiment to determine the rate of growth and reproduction of animals receiving a typical institutional dietary and to discover the effects of an addition of milk to that scale, and a survey of the milk consumption by Europeans in a number of households. Specialized investigations on calcium and phosphorus metabolism, analytical work on food-stuffs, and examination of the results of free issues of milk to native school children in Nairobi are also being continued.

6. *Practical Measures for Improvement of Nutrition*.—These cover two aspects, agriculture and health, and involve (a) instruction at veterinary training depots on the improvement of native cattle; the establishment of small holdings, demonstration gardens and plots; the improvement of food crops by the introduction of new varieties of cereals, pulses, vegetables and fruits (particularly the citrus and the avocado pear), as well as by local selection for high yields and resistance to disease; introduction of mixed arable and stock farming; instruction in pasture management and conservation of fodder; and (b) the provision of properly balanced diets in hospitals, schools and prisons; the establishment of child welfare centres; propaganda on the public health aspects of nutrition at exhibitions and shows; education on diet and nutrition in schools.

In an article\* by the late Director of Education in Kenya, a description is given of measures undertaken by the Educational Department towards providing the West Suk tribe with

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\* "*Africa*", 1937. 10, 458-471.



the means of securing a greater variety of crops and so improving their dietary. A boarding school for 40 youths was opened in 1931, in which, in addition to the ordinary elementary school curriculum, training was given, in plots attached to the school, to enable the pupils to grow crops suitable for the country in which they live.

### TANGANYIKA.

|                                 |               |                          |  |
|---------------------------------|---------------|--------------------------|--|
| <i>Area:</i> 374,085 sq. miles. |               | <i>Birth Rate:</i>       | } No<br>reliable<br>statistics<br>available. |
| <i>Population</i> (1931).       |               | <i>Infant Mortality:</i> |  |
| Europeans                       | ... 8,200     | <i>Death Rate:</i>       |  |
| Asiatics                        | ... 32,000    |                          |  |
| Natives                         | ... 5,022,640 |                          |  |
| <hr/> Total ... 5,062,840 <hr/> |               |                          |  |

1. *General*.—A specially appointed local Committee has submitted a report of 16 pp., dealing chiefly with the practical measures towards securing improved nutrition and to a less extent with the scientific and medical research aspects. [For additional information reference may be made to “The Tribes of Tanganyika—Their Districts, usual Dietary and Pursuits,” by R. C. Jerrard, and to Imperial Bureau of Animal Nutrition, Technical Communication No. 8, pp. 17-18.]

2. *Composition and Nutritive Value of Dietary*.—The report refers to the work of Jerrard in recording the customary foods of each tribe in the eight provinces (54 separate districts) of the Territory. These include millet, mtama, maize, rice, ground-nuts, beans, cassava, sweet potatoes, native vegetables, fish, meat, mutton, goat flesh, milk, blood, etc., and are used in different proportions and with widely varying preferences by different tribes. For example, some tribes prefer root crops (cassava) while others do not; millet is the staple in some districts, rice in others; blood, meat and milk form the main food of certain nomadic pastoral tribes; and fish is commonly eaten by coast tribes and in the Lake Province but rarely elsewhere. Little is known about the various ingredients used as supplementary relishes (“kitoweo”) which constitute a very important part of the dietary. It is generally agreed that the majority of the population does not get enough meat and milk and that there is an annual period of food shortage between harvests. This periodic shortage of food, involving a recurrent annual drain on native resources, is a question even more serious than the occasional outbreaks of famine which have occurred in nearly all provinces during the past ten years, and which cost considerable sums in relief measures. Taboos and tradition are also important factors and are sometimes the cause of protein and vitamin shortage. A taboo on eggs and milk, for example, may operate even during a shortage of staples.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Although deficiency diseases have been reported in many districts, particularly beriberi and rickets in the Tanga province and scurvy in the Lupa area of the Southern Highlands, information is not available to determine with any accuracy the extent and prevalence of malnutrition throughout the whole territory. While cases of malnutrition are common enough following serious shortage or failure of staple crops, it is impossible to say whether in a prosperous year any tribe suffers as a unit from food deficiency. Nor is there any exact information to indicate how far conditions of malnutrition are complicated by parasitic infection nor how far deficient nutrition causes or increases susceptibility to such infection. It is recognised that natives living in stock rearing areas are more energetic than those from districts where meat and milk are less plentiful. By improving dietary conditions on estates one large employer increased his average daily turn-out of labour to 98 per cent. as compared with a previous normal of 45 to 50 per cent.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—There is no doubt that improved distribution of available food supplies would lead to improved nutrition. Particularly is this needed in such an area as the Lupa goldfields where malnutrition exists through lack of fresh foodstuffs aggravated by economic difficulties. A major problem is the tsetse fly menace which prevents the people in two-thirds of the territory (one-sixth of the population) from keeping domestic animals for milk and meat production. In other areas, enzootic disease, density of population and seasonal starvation of animals limit the supply; and the fact that so many owners regard their stock as currency (for marriage dowries, etc.) also precludes the slaughter of cattle for ordinary consumption as meat.

Improvement in quality of food must be an ultimate aim, but the immediate need is greater quantity. The preharvest shortage is serious in some districts and is due to the inherent improvidence of the native who plans his agricultural output to allow only a bare sufficiency for himself and then overdraws on this minimum when the store is at its fullest after harvest. While the development of economic crops such as coffee and cotton is essential to the progress of the African and of the territory, the cultivation of food crops is equally essential. It should be a first consideration to ensure that each family in a tribal area cultivates major food crops sufficient for its needs.

5. *Researches and Surveys.*—[See also Note on the work of the Standing Medical Research Committee for East Africa, p. 10 above.] Existing knowledge is based on the opinions of many observers rather than on scientific enquiry. Little research has hitherto been undertaken. The report stresses the need for obtaining exact knowledge regarding the basal metabolism and energy exchange of the native to ascertain if and to what extent the European standard of nutrition deviates from that of the



African. Other studies which appear desirable include the chemical examination of foodstuffs; medical surveys of nutritionally poor districts; comparative dental studies regarding the relative immunity to caries found among primitive tribes and the higher incidence of dental disease among town dwellers influenced by alien civilisation; and the extent to which parasitic infection influences native nutrition.

6. *Practical Measures for Improvement of Nutrition.*—A lack of appreciation of the importance of nutrition is one of the most important barriers to progress. The lines along which it is suggested that action should be taken include: better distribution and utilisation of stock with a view to improving the supply of meat and milk; development of better stock routes from cattle areas; rotational grazing; improvement of pastures; improved production of milk and of good quality ghee by means of creameries; encouragement of the use of skimmed milk and cheese made from locally-produced skimmed milk; encouragement by propaganda and example of the use of palm oil; protection of the public from adulteration of foodstuffs by the introduction of appropriate legislation; encouragement of vegetable growing; extended maternity and child welfare services; establishment of school gardens for the cultivation of tomatoes and green vegetables; instruction in anti-tsetse measures; encouragement of the use of shark oil and cod liver oil at tribal dressing stations; improvement in methods of food storage; and the establishment of communal kitchens by the larger industrial concerns.

The reviewing Committee recommend that in order to bring them within the purchasing power of as many natives as possible, tinned milk, tinned and dried fish, salt and unmilled rice be exempt from Customs duties and that the licence fee imposed on sellers of dried fish be abolished. The Committee also invite attention to the unsatisfactory conditions under which labourers on certain industrial undertakings are fed, and they express the hope that such remedial measures as may be practicable will be progressively enforced.

#### UGANDA.

|                           |                   |           |  |
|---------------------------|-------------------|-----------|--|
| <i>Area:</i>              |                   |           | <i>Birth Rate:</i> 26.42 per 1,000 (1936).               |
|                           | <i>sq. miles.</i> |           | <i>Infant Mortality:</i> 158.64 per 1,000 births (1936). |
| Land ...                  | ...               | 80,371    | <i>Death Rate:</i> 19.60 per 1,000 (1936).               |
| Water ...                 | ...               | 13,610    |  |
| Total ...                 | ...               | 93,981    |  |
| <i>Population (1935).</i> |                   |           |  |
| Europeans ...             | ...               | 1,994     |  |
| Asiatics ...              | ...               | 14,860    |  |
| Natives ...               | ...               | 3,644,245 |  |
| Total ...                 | ...               | 3,661,099 |  |

1. *General*.—No *ad hoc* Committee has been appointed, but a nutrition sub-committee of the permanent Agricultural Survey Committee has surveyed the position and submitted a report. In addition, a memorandum from the Director of Medical Services, and two reports dealing with health and agriculture in Teso have been submitted. These are (1) “An investigation into health and agriculture in Teso, Uganda,” Agricultural Survey Committee, Nutrition Report No. 1—Teso, 1937, by De Courcy-Ireland, Hosking and Loewenthal, and (2) Report of an informal Committee appointed to consider certain questions relating to agricultural, forestry and stock conditions in Teso District.

2. *Composition and Nutritive Value of Dietary*.—The native dietary is primarily vegetarian and consists chiefly of bulky carbohydrate foods. Plantains form the staple food in the Buganda Province and in parts of the Eastern, Northern and Western Provinces. In the rest of the country grain is the staple, the small millet (eleusine) being the commonest. Beans and peas are the staples in Kigezi and Ankole. Groundnuts, a commercial crop in the Eastern Province, are eaten freely when available. Wheat and rice are grown in certain areas but maize is not grown to any extent. Sweet potatoes, great millet (sorghum), cassava, simsim, pumpkins, gourds and native spinach are secondary foods used in varying proportions.

All tribes eat meat occasionally but not regularly. In cattle districts milk is consumed, generally curdled and very often mixed with cattle blood. Fish, both fresh and dried, is popular whenever obtainable among tribes living adjacent to lakes and rivers. Locusts, grasshoppers and white ants are universally eaten as delicacies. Fruit does not ordinarily enter into the diet, but figs, tamarinds and the fruits of the shea butter tree and borassus palm are occasionally used to supplement the routine diet. The consumption of sugar is steadily increasing and tea and coffee drinking is gradually becoming habitual with natives. Food taboos are common, e.g., chicken and mutton are not eaten by Baganda women and milk is often barred to male adults.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—The published investigations of Loewenthal, Mitchell, Owen, Hennessey and others indicate that there exists a very considerable amount of ill-health due to lack of first-class protein, fat, vitamins and possibly of minerals in the diets now consumed. Up to four or five years ago considerable trouble was experienced in Uganda prisons owing to multiple dietary deficiency the chief evidences of which were oedema, pellagra, xerophthalmia, night-blindness and other ocular disorganisations. This suggests that vitamin deficiency, particularly of the A-factor, must exist to a considerable extent among the free population. In recent years, however, prison diets have been so much improved that to-day deficiency diseases are rarely



seen in Protectorate prisons. Another important line of inquiry refers to tropical ulcer which is very prevalent and is considered to be of dietetic origin. Ulcers are of less common occurrence where the diet is richer in calcium and fat, and are scarcely ever met with among native chiefs and houseboys whose circumstances permit of their obtaining a regular and adequate diet including meat and milk. An important factor seems to be the quality of dietary protein. This is indicated by the prevalence of ulcers among vegetarian tribes and their absence in meat-eating tribes.

Observations by Loewenthal on vitamin A deficiency in the Teso area revealed that, of 1,112 individuals examined, both children and adults, almost 30 per cent. showed vitamin A deficiency. Other symptoms, such as neuritis, sore mouth, and skin infections suggest that the deficiencies were multiple in nature.

In the investigation into health and agriculture in Teso by De Courcy-Ireland *et al.* referred to in paragraph 1, two small administrative units were compared. In the one with a denser population and a negligible consumption of food of animal origin, the incidence of nutritional disease (eye troubles and ulcers) was markedly higher than in the other where there was less overcrowding and where fish was a regular constituent of the diet.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The methods of agriculture adopted by certain tribes are undoubtedly extravagant of land, and in many respects the present tribal system of land tenure is unsatisfactory. It is suggested that a proper appreciation of the value of land and of soil conservation can only follow if some method of land tenure ensuring continuity of ownership to the individual can be evolved. Teso is the agricultural district most affected by desiccation and soil deterioration. Here, natives normally cultivate land continuously until such time as, judging by reduced yields, it is becoming impoverished. To restore fertility this land is then allowed to rest, new plots being opened elsewhere. Owing to increased pressure of population, increased acreage of economic crops and increased cattle population, no adequate resting period is now being allowed, with the result that land fertility is not being maintained. A special Commission examining this problem in Teso in endeavouring to devise measures necessary to meet a situation which unless immediately dealt with may well become so serious that the natives will have difficulty in growing adequate supplies of food.

Water supply is a difficulty in certain areas. Undoubtedly Uganda could carry a very much larger population than at present if the sparsely watered areas could be provided with this necessity.

5. *Researches and Surveys*.—[See also Note on the work of the Standing Medical Research Committee for East Africa, p. 10 above.] Apart from the informative studies by Loewenthal and others referred to above, little research has been undertaken. Studies urgently required are the analyses of local foodstuffs (including the insects eaten), determination of native protein requirements, investigation of methods of cookery suited to native needs and best adapted to preserving the nutritive value of food, and anthropological research into the reasons for food taboos. Further surveys along the lines of that made in Teso (see paragraphs 1 and 3) are in progress and the Government is detailing a medical officer who will give his full time to this special work.

6. *Practical Measures for Improvement of Nutrition*.—On the agricultural side these include improved crop rotation, the introduction of new varieties of food crops and the improvement of cattle and milk supplies. The evolution of marketing systems and the establishment of recognised cattle routes has resulted in the price of meat being reduced to 25-30 cents per lb. as compared with 1s. (100 cents) per lb. 10 years ago. On the medical side, dietary scales have been laid down for prisons, schools, and hospitals. As an example to private employers of labour, Government has recently provided a well balanced diet to labourers employed on road construction. This has resulted in a very much lower incidence of sickness than is usual in such constructional works. Other measures include infant and child welfare work, health shows, and efforts to increase the consumption of milk. An increased consumption of fish is desirable and investigations are required with a view to better organisation of the fishing industry and the preparation and sale of fish.

## ZANZIBAR

(AND PEMBA).

|                                    |                   |  |
|------------------------------------|-------------------|--|
| <i>Area:</i>                       |                   | <i>Birth Rate:</i> 16.3 per 1,000                          |
|                                    | <i>Sq. miles.</i> | (1936).  |
| Zanzibar ...                       | 640               | <i>Infant Mortality:</i> No reliable statistics available. |
| Pemba ...                          | 380               |  |
| <i>Population:</i> 242,770 (1936). |                   | <i>Death Rate:</i> 16.8 per 1,000                          |
| <i>Distribution</i> (1931).        |                   | (1936).  |
| Europeans ...                      | 278               |  |
| Arabs ...                          | 33,401            |  |
| Indians ...                        | 15,246            |  |
| Africans ...                       | 186,466           |  |
| Others ...                         | 37                |  |
| Total ...                          | 235,428           |  |



1. *General*.—The local Committee, consisting of the Directors of the Departments of Health, Education and Agriculture, the Provincial Commissioner, and the Curator of the Museum have published Sessional Paper No. 2 of 1937, under the title of “Nutritional Review of the Natives of Zanzibar”, which deals mainly with the dietary problems of the rural African and to a less extent with the urban African and the immigrant Indian. Sessional Paper No. 10 of 1937, published under the title, “Nutritional Problems of Zanzibar Protectorate”, is chiefly devoted to the progress which has been made in applying the practical measures for improvement suggested by the Committee.

2. *Composition and Nutritive Value of Dietary*.—*Staple foods*.—Rice, coconuts and cassava. *Secondary staples*.—Fish, plantains, sweet potatoes, yams. *Subsidiary foods*.—Maize, millet, Kaffir corn, legumes, vegetables and fruits. Rice, half of which is imported polished, cassava, sweet potatoes, plantains and various flours form the bulk of the dietary; coconut oil is universally eaten and provides almost all the fatty food; while fish, almost the sole food of animal origin, is commonly eaten fresh or dried, but in small quantities as a relish rather than an essential. Green vegetables and legumes are less commonly eaten, and the consumption of meat, eggs and milk is negligible. A list of typical native dishes, with their mode of preparation, is given. Excessive carbohydrate and deficiencies in protein (both animal and vegetable) and animal fat are the outstanding characteristics.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—In common with neighbouring East African territories, vitamin deficiency (leg-weakness, sore lips, visual defects and xerophthalmia) is frequently found among prisoners in Zanzibar and has necessitated the revision of institutional dietary scales. Following a medical survey of prisoners in 1935, the introduction of a new prison diet resulted in a decrease of avitaminosis from 53 to 18 per cent. among long-term prisoners, whereas, among subjects imprisoned for less than six months, the incidence rose from 25 to 36 per cent. The conclusion is inevitable that a marked degree of avitaminosis exists among the free population outside the gaol, which, in the case of short-term sentences, cannot be counteracted owing to the insufficient time on the more adequate prison diet. This conclusion is supported by the fact that, as revealed by medical survey, only one-third of the rural African and Arab children can be described as well nourished.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—To provide for clothes, house repairs, fishing tackle and other essential outgoings, the rural native trades all his most valuable foodstuffs in the towns, buying for himself

cheaper food. Eggs are sold not eaten; milk is bartered not drunk. Nearly the whole milk supply of the Island is absorbed into the township, the largest consumers being the Indian community. The only fish eaten is what cannot be absorbed into the available markets. Meat is not eaten owing to high cost, though it is well liked when obtainable. While the qualitative dietary defects considered in paragraphs 2 and 3 are common both to country and town districts, the quantitative factor is more pressing in the town where there is a great deal of poverty. Probably 80 per cent. of the poorer town dwellers spend not more than Shgs.6 per month on food, a sum considerably below the monthly food expenditure of Shgs.10.50 found in the lowest of four distinct groups of more prosperous town dwellers (examined by Smith and Smith) whose diet even at that level showed marked deficiency of vitamins, animal protein and fat. Annually some 330,000 cwts. of rice and 750,000 lb. of ghee are imported. It is, however, the importance and value of the two main export crops—cloves and coconuts—which has hitherto overshadowed food crop cultivation. Indeed, the whole economic status of the native is primarily determined by the degree of prosperity in these two industries.

5. *Researches and Surveys*.—[See also Note on the work of the Standing Medical Research Committee for East Africa, p. 10 above.] Very little laboratory research and only one or two minor dietary and health surveys of limited scope have been undertaken. The reviewing Committee considers it highly desirable that more data be obtained on the precise nutritional quality of local foods both in the raw state and in prepared dishes, and concurrently that metabolism experiments be carried out to determine whether the energy requirements of the native are comparable to those of the European. By these means alone is it possible to say whether a diet, optimal for native energy and health requirements, can be made up from the common and normally available local foodstuffs. If, however, an enquiry of this scope were to be undertaken in the Protectorate itself additional financial provision would have to be made.

6. *Practical Measures for Improvement of Nutrition*.—These come under two heads, agricultural and medical, and involve (a) encouragement of the cattle and dairy industry in order to foster meat eating and milk drinking; extended food crop cultivation including suitable crop rotation, green manuring and soil improvement; the inauguration of a limited and experimental policy to encourage the extension of rice growing in Pemba; the cultivation of yellow maize to replace the local white variety; gradual replacement of the poor local variety of oil palm by a new variety from the Far East having a good oil-yielding pericarp, with a view to providing an edible oil rich in vitamin A;



improvements to the inshore fishing industry by the introduction of motor boats, the development of crayfish capture, methods of fish preservation and a by-products industry; and (b) continued attention towards further improvement of institutional dietaries; the provision of extra meals for school children, the paramount importance of which is specially stressed; the establishment of girls' schools with a bias towards domestic science training; the provision by Government of ante-natal clinics and maternity and child welfare services.

Steps have already been taken to inaugurate some of the above improvements, but, if they are to be effectively expanded, additional financial aid will be required particularly in respect of maternity and child welfare, school meals, and the suggested encouragement of the fishing industry.

### NORTHERN RHODESIA.

*Area:* 290,323 sq. miles.

*Population* (1934).

European ... 11,464

Native ... 1,366,425

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Total ... 1,377,889

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*Birth Rate:*

*Infant Mortality:*

*Death Rate:*

} No  
reliable  
statistics  
available.

1. *General.*—A standing Committee has been appointed and has submitted a report, to which there are several appendices; among them, observations by Mrs. Gore-Brown and Dr. Audrey Richards, and also a note by Miss Ricardo and Miss Owen on the fish of Lake Bangweulu.

In expressing their appreciation of the very interesting records put forward by Miss Richards and Mrs. Gore-Brown, the Committee wish to emphasise the fact that their data must not be taken to apply to all or even to most of the Protectorate. The high north-eastern plateau where their work was done is agriculturally perhaps the most unpromising part of the Territory inhabited by some of the worst farmers of the many tribes of Northern Rhodesia. A less gloomy picture would probably result from similar studies in, for example, the Luangwa valley.

2. *Composition and Nutritive Value of Dietary.*—(a) *Observations by Richards and Gore-Brown.*—The dietary customs, food consumption and cooking practices of the Bemba, a millet-eating tribe are described in great detail. Compared with European standards, the energy value of the diet is little more than half; there is a marked deficiency of fat ( $\frac{1}{8}$ th European standard) and of animal protein, which may even be entirely absent. A noteworthy feature is the high calcium intake (double average European intake) provided by the type of millet used (finger millet). For each of 300 days of the year, it has been

calculated that the resources of the Bemba would provide 0.9 lb. millet, 0.001 lb. beans or groundnuts and 0.016 lb. meat per standard man.

Conditions in the Bemba villages were compared with those in a typical cassava and fish-eating village in the Bisa territory. Here, owing to the presence of fish, the diet is much richer in protein and fat than the Bemba diet; but the staple carbohydrate, cassava, is much inferior to millet. Millet contains five to six times as much protein, fat, calcium and phosphorus as cassava and twice as much iron. Hence, so far as their carbohydrate food is concerned, the millet eaters have a distinct advantage over cassava eaters. In respect of physique and stamina, the Bisa are smaller, stockier, fatter, more energetic and better able to concentrate than the Bemba who, though tall and muscular have, almost invariably, thin legs and knock knees.

(b) *Other available information.*—Throughout this report mention is made of the following local foods; their availability and the native preference for them varies widely in different parts, but all of them find some use in native dietaries:—millet (red variety is superior to white), cassava, maize, sweet potatoes, groundnuts, beans, grubs, wood-lice, caterpillars, flying ants, honey and dried fish. A considerable proportion of the grain supply is used for beer making. Tribes without cattle and who neither hunt nor fish may supplement their diet with mice, river rats and insects. The ecologist (Trapnell), who contributes a section to the report, alludes to the inferior food value of cassava as compared with cereals, a fact which might have some significance in view of the advice being given to substitute cassava for cereals as a staple crop on account of its being less vulnerable to the ravages of locusts. Wild and cultivated spinaches, relish plants and salt-containing sedges are used in varying quantities; and the need for obtaining more precise knowledge regarding the value of these indigenous dietary extras is emphasised.

Very little meat is eaten and of milk there is hardly any mention. Even pastoral tribes do not always use their cattle for meat and in certain areas wild game, which should and did at one time form the natural meat supply, has become so reduced as to be in danger of extinction. Nevertheless, there are welcome signs of increased inclination on the part of some tribes to eat more meat, and contact with the European has had considerable influence in this direction. There has been a growing interest in meat since native butcheries were started and the native is always ready to buy or, when money is short, to barter for meat. An integral part of the campaign against bovine pleuro-pneumonia, which involves the slaughter of thousands of animals in Barotseland, is the education of the Barotse people



to eat meat and so put to valuable use cattle which must be slaughtered. Eggs, too, are gradually becoming popular although formerly never eaten and still not eaten at all by certain tribes. Large rivers, lakes and swamps provide a great part of Northern Rhodesia with vast potential supplies of fish. Several reports\* on the possibility of developing a fishing industry and extending the use of fish among natives are available.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—So far as Europeans are concerned the problem of malnutrition is confined to the poor South African farming class whose powers of resistance are obviously low on account of poor diet and bad general conditions of existence. In schools, day scholars of this class are markedly inferior in physique, energy and ability to boarders who receive a regular institutional diet.

In regard to natives the occurrence of deficiency disease is frequently reported. Scurvy and pellagra are not uncommon and it has been suggested that two local diseases “chiufa”† and “onyalai”‡ are of nutritional origin. Indications of vitamin deficiency, reported by Dry,‡ include hemeralopia, oedema, leg sores and pain in the limbs. The incidence of parasitic infection is high.

It will be convenient to refer here to conditions among mine labourers, and the scale of rations provided in mines about which much is written in the report submitted. The mining companies pass through their hands a continuous stream of natives from more than one area and general malnutrition is a common cause of rejection. In a group of 589 accepted adult male recruits the average weight was 9st. 2lb. (These recruits, however, included few, if any, from the Barotse valley where better physique prevails, probably associated with the inclusion of fish and milk, and often meat, in their regular diet.) Almost without exception increase in weight follows the full and regular diet provided at the mines. The Rhokana Corporation, who have given particular attention to this matter, are improving their existing dietary scales in the direction of reducing total calories by decreasing the supply of meal and beans but at the same time improving the health value of the diet by increasing the supply of meat and fat. On the basis of 6,000 employees this improvement will cost £7,526 a year more than the former diet, regarding which the Manager writes: “If an increased

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\* Moffat Thomson : Report on the Native Fishing Industry.

Pitman : Faunal Survey of Northern Rhodesia.

Worthington : Fishes (other than Cichlidea) of Lake Bangweulu and adjoining regions.

† Gilkes, H.A., Trans. Roy. Soc. Trop. Med. and Hyg., 1934, 27, 491.

‡ Dry, T. J : Avitaminosis in natives of Rhodesia. *Arch. Int. Med.*, 1933, 51, 679-691.

efficiency of so little as 5 per cent. could be guaranteed by the balanced dietary advocated, it would be a sound economic proposition ”.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—The chief economic interest of the territory is mining, there being little general trade in food commodities. The awakened interest in nutrition, however, places a new emphasis on the importance of developing subsistence agriculture, a matter of especial importance in Northern Rhodesia where practically the whole of native food requirements are produced by primitive methods in village gardens. In spite of limited resources the Agricultural Department is doing much to assist in the creation of model native settlements in which a more liberal and varied diet will play its part.

5. *Researches and Surveys*.—(See also Note on the work of the Standing Medical Research Committee for East Africa, p. 10 above). With the exception of those by Dr. Richards and Mrs. Gore-Brown, no surveys have been undertaken; nor has any other type of nutritional research been carried out. The Committee recognise the need for the study of native metabolism under conditions of village life; of the relation between diet and physical condition; and of the nutritive value of local foodstuffs, especially those adventitious foods and dietary “extras” which are widely used. The Committee consider that the appropriate body to plan, organise and supervise future studies and researches in Northern Rhodesia is the Standing Medical Research Committee in East Africa.

6. *Practical Measures for Improvement of Nutrition*.—The Committee recommend the amendment of the Employment of Natives Regulations in two respects: first, so that the requirements regarding the feeding of agricultural, domestic and casual labour should be brought into line with the scales already in force for the feeding of labour on mines and should include a clear obligation to supply meat and fresh vegetable foods. At present the only obligation upon an employer of agricultural labour is to provide “good and sufficient rations” or money in lieu. This is usually interpreted as 2 lb. mealie meal per day with or without salt in addition. Secondly, if the new Rhokana scales (see paragraph 3) prove successful, they should be adopted by all employers of mine labour in the Protectorate. The Committee also recommend that the Department of Agriculture should be provided with adequate funds to enable it to attempt to adapt traditional methods of agriculture to changing conditions and to develop production for food and for sale wherever this is practicable. Other recommendations have reference to systems of land tenure; alterations in coinage; and the development of transport facilities at costs below present



rates. The transport question is regarded as of major importance, one of the fundamental problems in connection with improved nutrition being the movement of foodstuffs from areas where they are available or even surplus to areas where they are in demand but unobtainable. Dr. Richards contributes additional suggestions, namely, the greater encouragement of maize growing to obviate food shortage, since the maize crop ripens two or three months earlier than the staple millet crop; the encouragement of poultry keeping and fruit and vegetable growing; organisation of the fish trade; improvement in methods of storing and cooking food; education in agricultural and marketing methods; and research on infant feeding. The Committee give a general endorsement to all these suggestions as meriting serious consideration by the Native Development Board, a body which, the Committee note with satisfaction, it is proposed to set up with the object of furthering native interests and through which the Committee envisage the possibility of definite progress being made towards improved native nutrition.

The part which, for the present, the Medical Department will play in relation to the improvement of nutrition will be the increase so far as possible of maternity and child welfare work, and the collection and supply of information to guide the activities of the Administration and the Departments of Education, Agriculture and Veterinary Services.

#### NYASALAND.

|                                |     |           |                          |                                  |
|--------------------------------|-----|-----------|--------------------------|----------------------------------|
| <i>Area: 47,949 sq. miles.</i> |     |           | <i>Birth Rate:</i>       | } No<br>statistics<br>available. |
| <i>Population (1936).</i>      |     |           | <i>Infant Mortality:</i> |                                  |
| European                       | ... | 1,836     | <i>Death Rate:</i>       |                                  |
| Native                         | ... | 1,619,530 |                          |                                  |
| Asiatic                        | ... | 1,558     |                          |                                  |
|                                |     | <hr/>     |                          |                                  |
| Total                          | ... | 1,622,924 |                          |                                  |

1. *General*.—No special *ad hoc* Committee has been set up but the question of nutrition has been referred to the Native Welfare Committee which has submitted a report.

2. *Composition and Nutritive Value of Dietary*.—Maize is the staple foodstuff except in areas where the soil is unsuitable for its cultivation, where cassava is relied upon. Rice is grown principally for sale. Unless the crop has been a heavy one only a small quantity is reserved for home consumption or special occasions. The basic foodstuff is not changed with the seasons. It only varies when there is a shortage of the popular foodstuff. The margin between sufficiency and shortage is fine. In cassava-producing areas there is rarely if ever any lack of food. In maize country some cassava is usually grown as a reserve

against scarcity. The staple food be it maize, cassava or millet, is always eaten in the form of a porridge prepared from a flour which in the case of maize is made from husked grain. Although meat is relatively cheap its price places it out of the reach of the average villager, who depends on game, small rodents, caterpillars, flying ants, locusts, etc., augmented by fish, for his intake of first-class protein. The amount of milk consumed varies from tribe to tribe and depends on custom, but on the whole it is not regarded favourably by adults. Goats' milk is never drunk. On the Lake shore there is a considerable industry in the smoking and drying of fish for sale but curing is done in a very indifferent manner. Fish is more generally used than meat, but both play a minor part in the native dietary. Chickens are reserved for ceremonial occasions or for sale to Europeans. Eggs are neglected on account of tribal taboos. Tea is being used more and more by the urbanised natives. Local vegetable relishes play a very important part in the native dietary. Relishes are cultivated and uncultivated and consist of the roots of plants or in many cases the young shoots, the leaves, the seeds or the flowers. Edible fungi are much sought after. Beans of many varieties, peas and groundnuts are also regarded as relishes. Beans are important as the main source of protein in the dietary, groundnuts are almost the sole source of vegetable fat. Such fruit trees as exist are almost invariably the result of chance germination. The native is not inclined to plant for posterity. Tomatoes are the most popular of all the European vegetables introduced in the country. Onions are next in popularity. In addition to a salt purchased from local stores or obtained from Europeans in exchange for eggs various locally prepared "salts" are in use, made by pouring water over the ash of burnt vegetables. The manufacture and consumption of beer varies according to the amount of material available. In some districts it is brewed and consumed the whole year round, often to the detriment of food supplies.

According to the standards accepted for non-tropical races the natives' intake of first class protein is inadequate, more especially during the important periods of childhood, pregnancy, and lactation. The consumption of fats is also too low when measured by the same standards. The fats are, moreover, mainly of vegetable origin. The intake of carbohydrate is adequate, if not excessive. Death from starvation is practically unknown. The intake of Vitamins A and C during certain months must be reduced to a dangerously low level, particularly of the latter, as it is not customary for vegetables to be eaten uncooked.

The tendency for natives to adopt European attire is to be regretted since it is bound to limit the synthesis of Vitamin D. It is probable that local diets are deficient in calcium and phosphorus, yet a valuable source of these minerals in the shape of maize bran is given to domestic animals.



3. *Diet and Health (deficiency diseases and other relevant considerations.)*—The grosser manifestations of deficiency disease are undoubtedly rare. There is a high incidence of catarrhal affections, conjunctivitis and tropical ulcers, which may be regarded as indicating a latent state of malnutrition in the population. Pellagra is not confined to the prison population but since the disease was first recognized in 1910 the majority of cases recorded have occurred among the inmates of the Central Prison, Zomba. Various measures have been tried including the introduction in 1922 of an improved dietary, but cases have continued to be reported. Treatment by means of dilute hydrochloric acid and thyroid extract has also been employed.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—There are wide fluctuations in the price of food-stuffs from year to year, maize for example varying in price from 1½d. to 7d. for 14 lbs. It has been estimated that to provide what is believed to be an improved diet for an adult native would cost approximately 3s. 5d. per week at current rates prevailing in Zomba. A real shortage of food almost amounting to famine occurs from time to time as a result of failure of the rains, of floods, of a poor harvest or of waste.

Nyasaland is not a food-exporting country; its main export cash crops being tobacco, tea and cotton. A certain amount of inter-district trading occurs but only the surplus is so disposed of. As a rule the cultivation of cash crops does not adversely affect the production of food crops. Low or falling prices have taught the native not to sacrifice his food supply in the hope of receiving a large return from cash crops.

The activities at the Lupa Gold Fields, Tanganyika Territory, have resulted in a demand for cattle and over 1,200 were exported from Karonga in 1936. About 95 per cent. of the cattle in the country are located in the Northern Province. A ghee industry has been established in the Mzimba district by private enterprise under European control. Although, however, cattle, sheep, goats and pigs are kept the people of Nyasaland are concerned mainly with agriculture. Land is owned by the community, though cultivation is, with few exceptions, individual. There is no system of crop rotation practised in connection with the cultivation of food crops. The benefits arising from the use of kraal manure or compost are appreciated in very few districts. It is generally agreed that the native family could produce more food without additional labour by adopting better methods of agriculture. In spite of constant propaganda and instruction the native is slow to alter his customs.

Prices obtainable for cash crops are low and the area that can be cultivated for food and cash crops under the family system is limited. The return is so small that there is little

incentive for the average native to produce more than is necessary to feed himself and his family according to custom and to earn sufficient to pay his liabilities to the Government in the form of hut tax.

5. *Researches and Surveys*.—No special investigations had hitherto been carried out on the subject of Nutrition in Nyasaland. The native Welfare Committee therefore recommended that a detailed survey of conditions of village life, tribal customs, taboos and racial prejudices together with a physical examination of the inhabitants in a selected district should be undertaken as soon as possible. Foodstuffs should also be collected for examination, tabulation, and analysis. They suggested that a skilled team consisting of a medical officer and an anthropologist and an analytical chemist should be chosen to do this. The objects in view will be secured by the survey at present being carried out with the co-operation of the International Institute of African Languages and Cultures and under the scientific direction of Dr. B. S. Platt, who, in accordance with the recommendation of the Economic Advisory Council's Committee on Nutrition in the Colonial Empire, has been appointed by the Medical Research Council to co-ordinate surveys on diet and health in colonial territories.

The Native Welfare Committee have also stated that investigations by a fishery expert are required in order that advice may be obtained on the potentialities of Lake Nyasa, and on measures to conserve fishery resources. These are also being undertaken.

6. *Practical Measures for Improved Nutrition*.—Among the measures already carried out are the provision of free milk for children in certain schools; establishment of native markets; maintenance of maternity and child welfare centres; improvement of institutional dietaries; training of native workers; establishment of school gardens; opening of suitable experimental stations in the charge of officers of the Agricultural Department; the development of native cattle; demonstrations by the Veterinary Department of the manufacture of ghee; health propaganda; the teaching of domestic science in girls' schools and the training of African midwives and nurses.

As regards measures for the future, the standard of living must be raised before a substantial improvement can be anticipated. This can only be achieved by the combined efforts of the technical departments directly concerned. Employers of labour might be prepared to accept recommendations regarding an improved dietary if assured that this would result in increased efficiency and better health. Employed labour forms, however, a small proportion of the total population. Schemes to improve the nutrition of the people must be associated with a better sanitary environment, and it is suggested that trained African



sanitary inspectors, dispensers, agricultural and veterinary instructors, Jeanes teachers and community workers should be provided to assist in achieving this. More time should be devoted in the centres for teaching the principles of nutrition and hygiene and a course of lectures on dietetics should be introduced in the syllabus in the Jeanes Centre. Extension of the maternity and child welfare centres would be of value and when sufficient data are available a simple text book on nutrition should be compiled for the guidance of African teachers and others giving instruction in this subject. Intensive propaganda should also be instituted in other directions. Investigations should be undertaken to improve methods of curing fish for native consumption, the meat supply might easily be increased, and increased provision of groundnuts and soya beans should be encouraged by all officers concerned. The export of oil seeds and possibly even of cotton seed should be carefully watched. Instruction in cultivation of vegetables and/or much greater issue of seed bought wholesale should be undertaken. Every village should have a communal orchard and a start should be made by improvement in the villages of Native Authorities. Demonstrations should be made of growing, harvesting and storing root crops in areas which suffer most from food shortage and encouragement should be given to the local manufacture of impure " salt ".

## WEST AFRICA.

## GAMBIA.

*Area:* 4,000 sq. miles.

*For Bathurst only.*

*Population.* 199,529 (1931).  
(Bathurst: 14,141) (1936).

*Birth Rate:* 25·2 per 1,000  
(1936).

*Infant Mortality:* 369·7  
per 1,000 births (1936).

*Death Rate:* 30·5 per  
1,000 (1936).

1. *General.*—A standing Committee has been set up, consisting of senior representatives of the Departments of Health, Agriculture, Education and Customs. The Governor has submitted a survey prepared in consultation with this Committee, together with a report from the Senior Medical Officer.

2. *Composition and Nutritive Value of Dietary.*—Unlike the other African dependencies, the bulk of the staple diet of Gambia—rice in the polished state—is imported. During the months from August to December, millet and guinea corn take the place of rice. Secondary foods are yams, coco-yams, cassava, pigeon pea, ragi, okro, pumpkin, tomatoes, citrus, and other fruits. Plantains are rarely seen in the Gambia. There is, however, no standard diet in the Colony, marked variations existing among different tribes and in different parts. For example whereas the Fullahs and Sarakoolie use butter and milk all the year round, other tribes use these for only a few months and in Bathurst fresh milk is practically unknown. Consumption of meat, fowls and eggs is negligible. Fish, both fresh and dried, is eaten in considerable quantities in Bathurst but to a less extent in outlying districts; it is often of the dried variety. In general, the diet is excessive in carbohydrate and deficient in the protective food substances, animal fat and protein, mineral salts and vitamins.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—In a country having conditions of imperfect sanitation, a vast amount of malaria and a high incidence of parasitic infection, trypanosomiasis and tuberculosis, it is difficult to estimate the precise influence which the customary diet of the people has on their health. Nevertheless, the high infant mortality, the marked prevalence of dental caries and the frequent manifestations of vitamin A and D deficiency are clear evidence of dietary inadequacy. Beriberi is comparatively rare, but mild cases of neuritis are not uncommon. A characteristic is the physical and mental lethargy of the native farmer which is undoubtedly due, in part at least, to lack of proper food.



4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The economic life of the Gambia is characterised by an exclusive preoccupation with one money-crop, the groundnut. The farmer concentrates on the production of groundnuts to the almost total exclusion of their use as a food and at the expense of other forms of food crop cultivation. The bulk of production is exported in return for imports of rice, and any policy of increased cultivation of other foods at the expense of the groundnut would have, in its early stages at any rate, an adverse affect both on the money wealth of the people and on the revenue of the Colony.

5. *Researches and Surveys.*—Although fuller study of diet and nutrition is desirable and indeed necessary, no scientific research has yet been undertaken nor can be without expensive additions to the present staffs. Co-operation could, however, be effected with other West African colonies where much superior laboratory facilities already exist. It is suggested that the Research Fellowships awarded by the Medical Research Council for work in tropical countries should include one on nutrition.

6. *Practical Measures for Improvement of Nutrition.*—Efforts to strengthen and diversify the dietary of the inhabitants can be, and are being, directed through agricultural and veterinary channels. Certain steps, including dry season irrigated cultivation, are being taken to increase the acreage under rice with a view to encouraging the consumption of the unpolished variety. An adequate supply of meat depends on the success of the anti-rinderpest and anti-tsetse campaign now being actively prosecuted and upon the abandonment of the old native idea of keeping cattle, not for sale, but as an outward sign of wealth—a custom which must be broken down. A more generous milk supply will also result from these measures. The introduction of poultry keeping would be an additional advantage. One measure which, it is suggested, might improve nutrition would be to increase the import duties on rice, canned fish and biscuits, and lower the duty on edible oils. Such changes would result in an immediate increase in the cost of living of the poorest sections of the community and are not recommended until the possibility of replacing these items by more suitable local food-stuffs, without altering the cost of living, has been more fully explored.

On the medical side, as much educational and propaganda work as possible is being carried out in mother and child welfare clinics, hospitals and schools; by means of health weeks and baby weeks; and by directing the attention of outstation Medical Officers, missionaries and native chiefs to the importance of improving the diet of the people.

## GOLD COAST.

*Area:* 91,843 sq. miles.

*Population:* 3,617,126 (1936).

*For 35 Registration Districts.*

*Birth Rate:* 34.5 per 1,000 (1936).

*\*Infant Mortality:* 108.0 per 1,000 births (1936).

*Death Rate:* 24.5 per 1,000 (1936).

*\*For the Colony only.*

1. *General.*—A survey, prepared by the Director of Medical Services dealing with the medical aspect has been submitted, together with a memorandum by the Director of Agriculture, dealing with the agricultural side of the problem. A Standing Committee including agricultural and other representatives has been set up to co-ordinate and inspire the policy of Government in the matter of nutrition, but, thus far, has presented no full report.

2. *Composition and Nutritive Value of Dietary.*—The main foods are:—

*North.*

*Staples:* Millet, guinea corn, yams, Fra-Fra potato.

*Secondary:* Maize, groundnuts, tomatoes, onions, groundnut oil, shea-butter, pepper.

*South.*

Coco-yams, plantains, yams, cassava, corn, meat, fish.

Groundnuts, maize, palm oil, shea-butter, fruit, rice, pepper.

Oranges, limes, mangoes, pawpaws, and bananas exist, but are scarce especially in the Northern Territory. Sugar cane is eaten raw. The leaves of many plants are used chiefly as spinach. Milk and eggs are very rarely eaten. Meat is scarce, of bad quality, exceedingly deficient in fat, and in general, too expensive for the bulk of the population. Smoked antelope, hippo, elephant and monkey flesh is very popular when obtainable. Fish is readily available on the coast, where an important dried and smoked fish industry flourishes. The better class African in the rural areas makes tinned meat and fish his main source of animal foodstuffs. A large form of roasted snail is considered a great delicacy in areas where it is plentiful. Salt is much appreciated. In some northern areas the people drink water impregnated to a milky colour with kaolin in preference to clear spring water, a habit apparently similar to the pica of Kenya described by Orr and Gilks.

Broadly speaking, the diet is deficient in those animal and vegetable foodstuffs which provide fat, good protein, vitamins and mineral matter. It is believed, but not proved, that the calcium content of the diet is poor. The protein content is



generally very low. This is especially noticeable in the miners' diet. There is also a definite deficiency of vitamin C in the diet of many of the poorer classes.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Food deficiency is a predisposing factor in many local conditions. Tuberculosis, the pneumonias and bronchitis are very prevalent and together account for 30 per cent. of all registered male deaths. Over 70 per cent. of persons in the coast town of Saltpond gave evidence of tubercle infection despite the fact that fish is available in quantity even to the poorest. There seems to be a close relationship between undernutrition and the incidence of leprosy in certain areas. Xerophthalmia and night blindness are not uncommon while pellagra and beriberi have been occasionally reported. Gross scurvy is unknown; but, although rare, a mild form of infantile scurvy has been seen. Rickets is practically unknown, only isolated cases being encountered. A nutritional disease (kwashiorkor), which in some respects simulates pellagra occurs in children breast-fed by foster mothers whose milk supply is inadequate and has to be supplemented with soured preparations of maize. Curative measures are found in a full diet of tinned milk, cod liver oil, eggs and fruit.

On the coast, where fish is plentiful, the standard of physique is higher than elsewhere. From sports records and such growth-rate data as are available it would appear that the physique of the African boy in town schools compares favourably with that of his European contemporary.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc).*—There are three systems of agriculture in the Gold Coast, corresponding to the three climatic zones, namely the coastal savannah, the high forest and the northern savannah. Nutritional problems vary with these zones. The coastal savannah is arid and in consequence sparsely populated and little cultivated. Meat supplies are insufficient owing to shortage of water for stock. Fish, corn and cassava are the staple products. For other foods, e.g. oils, sugar, meat and fruits, the people have to rely on imports, the cost of which is high.

The forest zone is climatically capable of producing any kind of tropical foodstuff. The growing of cocoa is, however, a source of income and there is a strong tendency to neglect the production of food and to use imported supplies instead. Nevertheless, the rougher starch foods such as cassava, maize and coco-yams are grown in considerable quantities. Tsetse fly prevent the keeping of cattle, but sheep, goats and poultry swarm in every village. Fruits, sugar and legumes peas and beans are neglected. Oils (groundnuts and palm-oil) are plentiful.

In the northern savannah food supplies are often deficient both in quantity and quality and water is scarce. Because of the distance of these areas from the coast and the relative poverty of the people, the northern savannahs do not supplement their nutritional deficiencies by imported foodstuffs. Fruits and green vegetables and articles promoting variety of diet in general are very lacking.

Speaking generally it may be said that agricultural and nutritional deficiencies spring in the case of the coastal savannah and of the forest zone, from the practice of shifting cultivation, whereas those in the populated northern savannahs arise from fixed or permanent farming inefficiently applied. Apart from the Northern Territories and the eastern region of the coastal areas, where conditions are favourable, the Gold Coast has no stock rearing industry. Wherever found, cattle are looked upon as an expression of wealth and only old animals are sold. The general population cannot afford to buy meat. The introduction of tinned foodstuffs has proved a mixed blessing in rural areas. Of poor quality and low food value, tinned foods may be obtained on credit, whereas local meat and fish must be paid for cash down. The development of the mining areas and of the cocoa industry has created great demands for foodstuffs. Yams, cassava, and groundnuts are transferred to these areas from agricultural districts, and the constant transference from one district to another has, on occasion, actually resulted in famine in the producing area. Price inflation is frequent. In Kumasi, groundnuts have been sold at £1 per bag as against a world rate of 4s.; and driven cattle costing £1 per head on the northern frontier have been sold to butchers for as much as £15 per head on the coast.

5. *Researches and Surveys.*—No nutritional researches have been carried out; but as conditions are similar to those in Nigeria, the analytical data and other findings obtained there by McCulloch have been accepted as applicable. Studies which appear desirable include surveys relating to diet and health and estimation of the nutritive value of local foodstuffs. It is suggested that the appointment of a full time dietetics research officer is essential.

6. *Practical Measures for Improvement of Nutrition.*—At present, these include the promotion of mother and child welfare; health visiting; school instruction in food hygiene and diffusion of knowledge and information to Medical Officers and social workers. In addition in the coastal savannahs the Department of Animal Health has conducted campaigns against rinderpest and pleuro-pneumonia. The coastal humpless cattle are highly resistant to trypanosomiasis. A livestock station has been established in the area and a programme will be put into



effect by the water section of the Geological Survey Department. The new road which will link Accra to the Keca-Ada areas and traverse the southern plains will probably induce gradual settlement of farmers in the area. Attention will be devoted to such matters as increase of the livestock population, improvement of pasturage, the introduction of cattle-ploughing and manuring, and the improvement and diversification of food crops.

In the forest areas the impossibility of maintaining cattle militates against any system of permanent farming. A system of trial unit-farms throughout the forest areas has been instituted in order to test the possibility of maintaining fertility by means of leguminous green dressings and various food crop rotations. Sheep might be a profitable source of manure and trials are proceeding at three centres.

In the populated areas of the Northern Territories the main lines of work are control of livestock diseases; improvement of pasturage; provision of water supplies; stimulation of mixed farming; propagation of improved strains of cattle; breeding and introduction of new types of food crops. The support given to the work by the Native Administration has been remarkable.

Permanent systems of mixed farming will do much to increase the peasants' food supply, to diversify crops and thus to ensure an adequate and balanced dietary. Special measures, however, will be required to stimulate the production of certain articles of diet including meat, milk, rice, fruit, fish, and salt.

## NIGERIA.

*Area:* 372,674 sq. miles.

*Population:* 20,224,367  
(1936).

*For Lagos Area only.*

*Birth Rate:* 29.2 per 1,000  
(1936).

*Infant Mortality:* \* 140  
per 1,000 births (1936).

*Death Rate:* 17.2 per  
1,000 (1936).

\* *Approximately* 250 per 1,000  
for whole country.

1. *General.*—No special committee has been set up. Committees have been in existence for some years, both in Northern and Southern Nigeria. As the various members expressed the opinion that ordinary inter-departmental co-operation was adequate, there has been, so far, only one meeting of each.

The following summary is based on:—

(1) the report submitted by Dr. J. G. S. Turner, Medical Officer in charge of Dietetics Research;

(2) notes of evidence given orally before the Committee of the Economic Advisory Council on Nutrition in the Colonial Empire by Sir Walter Johnson (lately Director of Medical and Sanitary Services);

(3) a Despatch from the Governor, relating to Dr. Alfred Clark's research on poisoning by food plants in Nigeria, together with a report on the formation of Health Propaganda Units.

2. *Composition and Nutritive Value of Dietary*.—The main foodstuffs are:—

*North.*

*Staples*: Millets, rice, beans, milk, green leaves, kuka leaves, meat.

*Secondaries*: Maize, groundnuts, onions, tomatoes, okro, shea butter, butter, honey, sweet potatoes, eggs, cassava.

*South.*

Yams, cassava, beans, green leaves, coco-yams, plantains, meat, fish.

Groundnuts, iru, okro, maize, palm oil, shea butter, fruit, sweet potatoes, nuts, eggs, shell-fish, rice.

In the North the people are mostly grain eating, whereas in the South they are root-crop (yam) eating. The native method of preparation of cereals involves removal of the pericarp and hence loss of nutritive value. Meat is expensive and, on the whole, the people are meat-starved. The average peasant never eats it except perhaps in the Northern cattle-rearing areas where it is taken probably once a week. Milk is not readily available nor its use customary, many regarding it with distaste although readily converted to it. In the North (Zaria) a recent inquiry revealed that husbands took most of the available meat and milk, wives came next and children got what was left. Fish is plentiful on the seaboard and along inland rivers. Wherever it is eaten, physique is markedly superior. Away from rivers dried fish is the chief source of animal protein. In the North and many parts of the South, fruit is not available. In the dry season fresh green food may be unobtainable for six months at a time (during which the native relies on dried kuka leaves), and the people may be subject to periodical semi-starvation before the new season's crops are ready. Beniseed, which has a high mineral content, is grown for consumption in certain areas. Where this takes place (e.g., among Munshi and Plateau pagans) physique is superior. On the whole, town dwellers are better fed than the ordinary village peasants; but the bush Fulani, a nomadic cattle-owning people, have better physique than the settled Hausa whose diet is known to be deficient.



The main difficulty is qualitative not quantitative. The average diet is high in starchy foods but very low in animal protein and fat, vitamins and minerals. Everywhere that institutional diets have been supplemented with protein, results have been good, e.g., in prisons and boarding schools. Deficiencies of the B-vitamin group are noticeable, especially in schools and during famines. In the North at the end of a long dry season vitamin C shortage is probable. The feeding of local diets to experimental animals demonstrated that optimum growth did not occur unless supplements of protein, minerals and vitamin concentrates were given. It remains to be said, however, that certain sections of the community have a wholly adequate diet and as a result have splendid physique.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—(a) *Deficiency disease.*—In normal years there are no marked signs of deficiency disease; but in the north in famine years beriberi is commonly found. There is a patchy distribution of goitre especially among women in whom the incidence may be as high as 60 per cent. Dental disease is exceedingly common; and there is a generally low resistance to anaemia, pneumonia, tuberculosis and leprosy. Anxiety is being caused by a pellagroid condition, described as optic neuritis, occurring among the boarding-school population and unemployed labourers of the cassava-eating people in the Southern Provinces (Lagos). Clark ascribes this to chronic hydrocyanic acid poisoning; but probably a B-factor deficiency is also concerned. (Nicotinic acid is now being tried in the treatment of this condition.) The condition is associated with poverty and is found not so much among day scholars, who are accustomed to a more varied home diet, but in boarding schools where food preparation is faulty. Poverty diseases and leprosy are also commonly seen in the central part of the Southern Provinces, a district consisting chiefly of small farms and few towns, where pressure of population is acute and has led to forced emigration. (b) *Vital statistics.*—The vital capacity of the Nigerian native is much below European standards. In growth rate and sports record he lags about 10 per cent. behind. Application of the Pelidisi and A.C.H. nutrition indices showed that in one Northern area about 50 per cent. of children were below normal, whereas on another area with a similar disease incidence but better food, only 20 per cent. were below normal. The poorest physique in the whole of Nigeria is among the forest mountain people in the Cameroons whose main article of diet is the banana. Fertility is high, but infant mortality is also very high. The expectation of life at birth is about 22 years in the North. It is stated that mortality rates in prisons have been reduced following dietary improvement but no precise figures are given.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Much of the present difficulty of bridging the gap between production and consumption is due to faulty marketing and inadequate transport. The cattle country of Nigeria is the North, and meat is transported from there to the South, where there are few cattle. In Kano, for instance, about 300 animals are slaughtered daily; but there is no well organised trade from North to South except to Lagos. A system of collecting depots, recognised cattle routes and resting areas is a necessity. As trekked at present, cattle frequently have a 50 per cent. mortality, and the cost of meat varies from 1d. to 1s. per pound depending on availability. Under existing conditions the provision of enough milk in the larger towns is impossible. Towards a general improvement of conditions in the North, the greatest single measure taken is the introduction of mixed farming. Thereby it is hoped to raise the economic status of the people, increase crop yields, make milk more available, and provide for the supplementary feeding of cattle throughout the dry season. Attention has repeatedly been drawn to the fact that valuable protein is leaving the country in the form of groundnuts, beniseed, palm kernels and cottonseed. Further, the ample fish supply on Nigeria's seaboard is still untapped.

5. *Researches and Surveys.*—The work begun by McCulloch in 1927 has been continued and developed by Turner, Fitzgerald-Moore and Clark. Turner proposes further extensions along the following lines: dietary surveys in areas having natives of contrasted physical condition; the establishment of comparative physical standards for different tribes; the analysis of data already available from school medical examination; the collection of infant age and weight records up to weaning; a study of the causes of infant mortality and the scientific aspects of late weaning (women suckle infants up to two and a-half years; weaning probably takes place later in the North than in the South); the collection of accurate statistics on birth and death rates. It is recommended that these researches, coupled with further biochemical examination of foodstuffs, should form part of a co-ordinated scheme involving organised team work and the employment of trained subordinate staff. It is also proposed to survey the South Western Provinces to gauge the precise nature and extent of the retrobulbar neuritis referred to in paragraph 3. If intelligent native co-operation is possible, it is hoped to ascertain exact living costs and obtain family budgets. It has also been recommended that the feeding of Lagos school children be undertaken on an experimental basis to determine whether, by supplementing the home diet with a suitable school meal, physical condition can be improved. It is suggested that assistance might be provided from the



Colonial Development Fund to enable a field experiment to be conducted on the value of supplementary feeding to children in some village, the result of which could be used for propaganda. Dr. Fitzgerald Moore has investigated the pellagroid condition to which reference has already been made. In areas where cassava forms the staple carbohydrate it is found that about 15 per cent. of children show signs of this disease. Of those affected about 10 per cent. suffer from eye defects which cannot be cured by glasses. During these investigations, in the course of which about 9,000 children were examined, an enquiry was made into school boarding house diets and it was found that the average protein consumption was only about 35 grammes a day in public schools as against 80 grammes in Government-controlled schools on approved dietary scales.

6. *Practical Measures for Improvement of Nutrition.*—These are of several kinds, some of which, such as the introduction of mixed farming have been touched upon in preceding paragraphs. Advice has been given to the Agricultural and Forestry Departments on the types of food and fruit trees the cultivation of which, from the nutritional point of view, would be most worth while extending. Vegetable gardens for schools and other institutions have been advised and in many places exist. In the North the solution of the milk problem lies in mixed farming. There is a small but growing trade in the export of eggs and butter from the North to the South. This should be discouraged until local needs are satisfied as good quality protein and fat are lacking in the North. In the larger population centres Government might devise some means of assisting the introduction of mills designed to improve the native milling methods, which involve the loss of the outer layers of the grain. In the South private enterprise has done something along these lines. The introduction of iodised salt into endemic goitre areas is also recommended. Action has already been taken in laying down satisfactory standards of dietary in Government hospitals, prisons and similar institutions.

The Directors of Agriculture and Education have promised co-operation with the Health Service in its propaganda work in schools and teaching institutions, and in the establishment of Rural Health Units. A Rural Health Unit is a representative Committee of voluntary workers who are co-operating with the propaganda branch of the Health Department in creating a health sense among the people and arousing the interest of Native Administrations in sanitary improvement. In the formation of these Units successful propaganda has been conducted by means of a mobile cinema which has recently completed a special lecture and demonstration tour of over 1,000 miles. This is a development which has great potentialities.

## SIERRA LEONE.

*Area*: 27,925 sq. miles.*Population* (1931).

Natives ... 1,667,790

Non-natives ... 4,268

Total ... 1,672,058

*Birth Rate*: 23·0\* per 1,000  
(1936).*Infant Mortality*: 210\* per  
1,000 births (1936).*Death Rate*: 20·8\* per 1,000  
(1936).

\* These figures refer to Freetown only. No reliance can be placed on data from outside Freetown.

1. *General*.—A special Committee has been formed and has submitted a report. A report by the Senior Medical Officer has also been received. In the latter, the available sources of information regarding diet and disease in Sierra Leone are treated chronologically from the year 1607 to the present time. The historical section is of interest in showing that observations regarding ocular disease and the toxic nature of cassava were made as early as 1792.

2. *Composition and Nutritive Value of Dietary*.—The staple foods are rice, palm oil, cassava, and fish (fresh or dried). Supplementary foods are groundnuts, beans, vegetables and fruits. Meat, chicken and eggs are eaten only sparingly and dairy produce hardly at all. Milk and butter (both imported) are beyond the reach of all but the well-to-do. The diet is therefore badly balanced containing excessive carbohydrate and insufficient animal protein and vitamins.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—From early writings it would appear that in the 17th century the natives were of fine physique and lived on a mixed diet with a sufficiency though not a superabundance of animal food. In the early and middle 18th century, conditions continued satisfactory but towards the end of the 18th and throughout the 19th century the diet deteriorated, particularly in respect of animal food deficiency. Outbreaks of avitaminosis A and B encountered in antenatal clinics, maternity hospital wards and schools are very common. The manifestations of the deficiency are glazed tongue, sore mouth and affected eyes, the lids often being devoid of eyelashes and gummed down by discharge. This complex of symptoms readily responds to treatment with cod liver oil and marmite. An analogous problem confronting the public health authorities is that of oedema which has been extensively reported upon as occurring in prisons, barracks and asylums. This was at first thought to be the wet form of beriberi but as no improvement



followed dietary treatment with yeast, cod liver oil, fresh vegetables and fruit, this diagnosis was discarded. The condition is now attributed to the eating of unwholesome and deteriorated rice. (For analogous finding, see under Fiji, paragraph 3.) Cures follow the replacement of faulty rice by fresh uncontaminated supplies. Deficiency of vitamins A and B appears to be exceedingly common throughout the territory and recent observations indicate that lack of sulphur, due to insufficiency of good protein, may also be associated with the syndrome. The prevalence of rickets among young children is also considerable, and goitre is endemic in certain districts.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The agriculture of the country is still primitive, “shifting cultivation” being universally practised. There is a definite shortage of cattle and small stock. It was suggested that an increase in stock might give rise to an increase in human trypanosomiasis, but the Director of Agriculture gives as his view that an increase in stock, necessarily possessing a high degree of immunity, would not be likely to increase the risk of human trypanosomiasis in a country where the disease is comparatively rare and wild ruminants are comparatively plentiful. Ten to twenty years ago there was a regular annual season of scarcity owing to insufficient production of upland farm rice to last through the year. Of recent years, however, owing to intensive propaganda, there has been a remarkable increase in the utilisation of swamp land for the cultivation of rice, the annual production of which has increased by 30-40 per cent. in the last 12 years. Increased production of other foodstuffs such as beans, maize, greens, tomatoes, yams, etc., has not been so easy, but is naturally most marked in those areas to which agricultural officers can devote most supervision. For example, the export of foodstuffs from the districts in which the Njala Agricultural Station is situated increased from 379 tons in 1926 to 2,183 tons in 1936. With a view to encouraging the consumption of foodstuffs of high nutritive value the Government has abolished the import duty on Empire milk and largely reduced that on foreign milk. More recently, the import duties on the following articles were either abolished or reduced:—biscuits, flour, edible oil other than soyabean oil, onions, salt, sugar and preserved vegetables.

5. *Researches and Surveys.*—The Committee conclude that it is impossible to frame a nutrition policy for the future without further knowledge of local conditions. Accordingly, they recommend that a comprehensive nutrition survey be undertaken to include analyses of native foodstuffs and investigation of the best means to implement dietary deficiencies out of local resources.

6. *Practical Measures for Improvement of Nutrition.*—Measures already engaging the attention of the Agricultural Department are the increase and improvement of local breeds of cattle and small stock, and the extended cultivation of fruit and vegetables. Satisfactory experiments proving the suitability of the Rhode Island Red breed of poultry have been undertaken; and a scheme to increase the production of food in mining areas has been drawn up and is likely to receive financial support from the Sierra Leone Protectorate Mining Benefit Fund. It is recommended that steps be taken to organise the fishing industry especially as regards methods of catching, preserving and distributing both fresh and salt water varieties. Red palm oil is especially rich in vitamin A and its use should be strongly encouraged. Steps to this end have already been taken. Quite recently an intensive campaign has been directed towards the improvement of infant nutrition, and provision for the training of women and girls in maternity and child welfare work is also receiving attention.

#### ST. HELENA.

*Area:* 47 sq. miles.

*Birth Rate:* 30.87 (1936).

*Population:* 4,341 (1936).

*Infant Mortality:* 120 per 1,000 births (1936).

*Death Rate:* 15.20 (1936).

1. *General.*—An isolated and mountainous island of 47 sq. miles, St. Helena has a population of about 4,000 people. The Islanders are of very mixed ethnological origin, including Chinese and Japanese elements. In stature they are small; in build, slim.

2. *Composition and Nutritive Value of Dietary.*—The diet of the Islanders consists of polished rice; fish, when available; milkless stick tea, very rarely a potato, lettuce or tomato. Early in life, malnutrition begins. Nursing mothers have very little milk and young infants a diet of rice-water and tea. Goats are sometimes killed for meat; but their milk is not used. Many have never tasted cow's milk, butter, cheese, or eggs. Fish are not numerous and are difficult to obtain; several hours of dangerous fishing often produce no more than a few mackerel, sold for sixpence, the purchase price of a little rice.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Irregular pulses and sub-normal temperatures are quite usual. Many children, after walking  $1\frac{1}{4}$  hours to school are too tired to perform physical exercises. Disease, malnutrition, physical and moral weakness are concomitant with the poverty which is almost at the level of starvation. About two hundred clear-cut cases of beriberi exist on the Island.



4. *Economics of Diet (relation to local agriculture).*—The production of “ New Zealand ” flax is the only industry. The plant is grown on the most fertile part of the Island, which is leased by three families. Workers are paid 2s. a day, the maximum which the present selling price of flax will allow. The low level of wages is reflected in the low standard of living. Almost the only other source of income is from the sale of lace and other articles to tourists. The foodstuffs used on the island are almost all imported.

5. *Researches and Surveys.*—The Government Dental Surgeon carries out dental inspection, but no details are available.

6. *Practical Measures for Improvement of Nutrition.*—Efforts are being made to increase the local production of vegetables and dairy produce. Instruction is to be given in domestic science and hygiene. The Government proposes to deal with the beri-beri cases by issuing vegetables, etc., to indigent sufferers.

## SOUTH AFRICAN HIGH COMMISSION TERRITORIES.

## BASUTOLAND.

*Area:* 11,716 sq. miles.

*Population* (1936).

|            |              |                          |                            |
|------------|--------------|--------------------------|----------------------------|
| Natives    | ... 660,546* | <i>Birth Rate:</i>       | } No statistics available. |
| Europeans  | ... 1,434    | <i>Infant Mortality:</i> |                            |
| Others ... | ... 1,604    | <i>Death Rate:</i>       |                            |
| Total      | ... 663,584  |                          |                            |

\* Includes 101,273 natives absent at labour centres.

1. *General.*—No Committee has been set up. The documents summarised include reports from the Director of Agriculture and the Principal Medical Officer, and a comprehensive study of Basuto dietary conditions by Mr. Hugh Ashton.

2. *Composition and Nutritive Value of Dietary.*—In considering nutrition in Basutoland, a distinction must be drawn between the highlands and the lowlands. The approximate area of the highlands is 9,364 sq. miles or four-fifths of the territory, and that of the lowlands is 2,352 sq. miles or one-fifth of the territory. Roughly speaking, the acreage under cultivation is 5 per cent. of the mountain area and 25 per cent. of the lowland area. The extent of cultivation is in approximate proportion to the number of people residing in the two areas.

Kaffir corn and maize form the staple food of the population; but wheat which has been grown in the territory for many years is now being produced on a rapidly increasing scale, and, together with peas, must now be regarded as a standard crop. It is displacing Kaffir corn both for ordinary dishes and as the main ingredient of beer. Peas, beans, root crops and sugar cane are subsidiary foods and various spinaches and pumpkins are used during the spring and summer months. Native beer is highly prized and is often drunk to the total exclusion of other foods. Meat is a luxury denied to at least half the population, the rest getting it only once or twice a month. In regard to milk and butter fat, few children get an adequate supply and a large proportion get none at all. Shortage of meat and milk is especially a lowland characteristic. Fish is not a significant article of diet, the rivers being poorly stocked.

Although a high carbohydrate diet and serious lack of protein, fat and vitamins prevails throughout the whole country, the position is, generally speaking, better in the highlands than in the lowlands, owing to the higher consumption of milk, wheat and peas in that area. It is unfortunate, too, that imported



foods such as tea, sugar, finemeal bread and cheap sweets are finding increasing favour in the lowland area, so that less money is available to purchase more nutritive articles.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—In the view of the Principal Medical Officer the nutrition problem will become very serious unless something can be done to stimulate the natives into changing their ideas and methods in regard to food. The proportion of badly-nourished people is greater in the lowlands than in the highlands and the progressive deterioration in the physique of mine workers, who are recruited chiefly from the lowlands, is becoming a subject of comment. According to residents of long standing, the physique and health of the Basuto to-day is not what it used to be. Malnutrition is seen in every village, dispensary, school and recruiting office. Mild scurvy and sub-scorbutic conditions are not infrequent; pellagra is becoming more and more frequent and lower resistance to disease increasingly apparent. It is becoming generally accepted, too, that the occurrence of leprosy is associated with faulty diet. Until weaning (Suto babies are weaned when about two years old) babies grow rapidly and strongly; thereafter, from lack of milk, they become thin and bony, and develop the characteristic pot bellies owing to excess of cereal food. Compared with European races, the Basuto are not active or energetic; but the women, who do most of the work, are capable of prolonged effort and endurance, although they have not the physical strength of the men. The only differences in their diet is that they often eat more than men, make greater use of spinach and green foods, and sometimes have more milk.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The root cause of the somewhat serious nutritional status of the people is over-population. Population has increased by nearly 100 per cent. in the last 40 years. The problem is especially pressing in the lowlands, but even the highlands are now becoming over-populated. Agricultural progress has not been in proportion to this increase in population, although remarkable advances in this respect have been made during the past few years. Continuous cropping has not been responsible for reduction in soil fertility to any marked extent. It is surface wash or sheet erosion, particularly in cultivated areas, that has been the factor mainly responsible. The chief causes contributory to this denudation and erosion have been over-stocking with inferior stock and bad distribution of stock; ploughing up and down slopes instead of along the contour; and shortage of fuel which necessitates burning manure for domestic purposes. The growing poverty of large sections of the population is repeatedly emphasised in these reports. Causes contributory to the present position are apathy towards adopting improved methods of cultivation and shortage of agricultural manpower, the best of which is recruited for mine labour.

5. *Researches and Surveys*.—With the exception of Mr. Hugh Ashton's study of the quantity and constituents of food consumed by Basuto families over certain periods, no surveys or other research work have been undertaken; nor does it appear that any special work of this nature is contemplated in the future.

6. *Practical Measures for Improvement of Nutrition*.—With assistance from the Colonial Development Fund and from Basutoland revenue, strong action has been taken to check existing and to prevent future erosion, thereby preserving the areas under economic crops and improving pasture land. Live-stock improvement is making rapid progress, the aim being to have better high-producing animals and only in such numbers as the territory can carry. Everywhere throughout the territory the production of peas and other legumes is being extended and encouragement is being given to increase the production of wheat, particularly strong wheat. A relatively recent campaign for the encouragement of the production of vegetables and fruit has met with marked success. There are already some 4,000 vegetable gardens in the territory, and with the extension of these all over Basutoland it is hoped to check and finally eliminate deficiency diseases. It is expected to distribute some 40,000 fruit trees annually, this number being available for distribution next season. To provide further supplies of fat and vegetable protein the production of ground nuts is being encouraged and Swiss goats are being introduced in order to furnish additional animal fat and protein.

## BECHUANALAND.

*Area*: 275,000 sq. miles.

*Population*: 260,064 (1936).

*Birth Rate*:

*Infant Mortality*:

*Death Rate*:

} No  
statistics  
available.

1. *General*.—No special Committee has been established, but the Resident Commissioner states that the Medical, Agricultural and Education Departments work in full co-operation, and he forwards notes of a conference held by these Departments to consider the possibility of supplying milk and cheese to school children. The Resident Commissioner submits a general statement in relation to the meetings of the Native Advisory Council. A report recently prepared by Sir Walter Johnson on Medical Administration in the Protectorate also contains information relating to nutritional matters.

2. *Composition and Nutritive Value of Dietary*.—It is agreed by all observers that natives of Bechuanaland live on a very poorly balanced diet and are suffering from a serious lack of vitamins, which may show itself in frank manifestations of nutritional disease or as lack of resistance to other diseases.



Poor water supplies are at the root of the evil and much is being done to remedy this, but it is also vitally necessary to educate the native in dietetics if his general health is to be improved. The normal diet consists almost entirely of maize and millet (Kaffir corn). The latter, brewed as beer, offers some vitamin as does the very scanty ration of meat and milk which may be taken; unfortunately cattle posts are so far from the villages that the most valuable article of diet, milk, is only obtained intermittently, especially by children who are attending school. A good wild spinach (*moroko*) occurs in the wet season but is not widely eaten; wild fruits (*moretla* berries and *marula* plums) exist, but people are generally too lazy to utilise them. A beer can be brewed from *marula* plums which has a high anti-scorbutic value. With the exception of the wild spinach, no use seems to be made of wild edible leaves, many of which are rich in mineral salts as well as in vitamins.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Besides lacking protein of good biological value the native of Bechuanaland is living on the verge of vitamin deficiency which shows itself from time to time in outbreaks of scurvy and in other symptoms of nutritional deficiency. Thus in 1935, following two seasons of drought, a serious epidemic of scurvy occurred in certain districts. Medical officers frequently report nutritional oedemas (especially in pregnant women), anaemias, skin rashes which clear up on administration of calcium and cod liver oil, muscular tenderness, etc. Night blindness and xerophthalmia are also said to be common and cases have occurred of complete necrosis of the cornea. Frank pellagra occurs but appears to be rare. The poor physique of the Bechuana is attributed to inadequate food. The average weight of five hundred adult males examined as to fitness for work in gold mines was only 8 stone 13 lb.; 33 per cent. were rejected as unfit. Adolescents are 20 per cent. below corresponding European weight standards. Susceptibility to malaria is high owing to malnutrition, and it is believed to play an important part in the spread of tuberculosis, which is becoming a matter of concern. Malnutrition is to be noticed in the children, especially in the younger children.

4. *Economics of Diet (in relation to local agriculture, cost, tariffs; etc.).*—The problem of nutrition is made up of poverty, ignorance with consequent indifference, and agricultural conditions. Periodical droughts are an important factor in the situation. During 1934 and 1935 there were severe droughts, with the result that cattle died in hundreds, milk was not available and green foods non-existent. Naturally, this seriously affected the health of the community as a whole, besides leading to outbreaks of scurvy in certain districts.

5. *Researches and Surveys*.—Investigation of malnutrition among children in the Ngwato Reserve and Tati Concession is proceeding.

6. *Practical Measures for Improvement of Nutrition*.—With the assistance of a grant of £114,000 from the Colonial Development Fund steps are being taken to improve water supplies throughout the Protectorate. The Medical, Agricultural and Education Departments have for some time been co-operating in measures to increase consumption of health-giving foods. The rapidly increasing activities of the Agricultural Department cannot fail to lead to improved nutrition. The growing of drought-resisting types of maize, the rearing of pigs, poultry and rabbits, the reclamation of worn out land which may enable farming to be undertaken nearer villages and the dissemination of knowledge by means of agricultural shows, are all forms of activity which will react upon the health of the people. School gardens are beginning to play an important rôle in the education of children. They teach the health value of various vegetables, fruit trees, etc., which can be grown. Hygiene now forms an important subject in the school curriculum. In addition to work at all the hospitals, two special maternity and welfare centres are in operation. The establishment of field dispensaries is being considered. Proposals have been made to issue free supplies of half a pint of milk or one ounce of cheese per head daily to children attending certain European and native schools, but the cost has so far been found to be prohibitive.

### SWAZILAND.

*Area*: 6,704 sq. miles.

*Population* (year not stated).

|            |     |         |                           |                            |
|------------|-----|---------|---------------------------|----------------------------|
| European   | ... | 2,735   | <i>Birth Rate</i> :       | } No statistics available. |
| Native     | ... | 152,159 | <i>Infant Mortality</i> : |                            |
| Eurafrican | ... | 644     | <i>Death Rate</i> :       |                            |
| Total      | ... | 155,538 |                           |                            |

1. *General*.—A brief report by the Medical Officer is submitted, under cover of a memorandum from the Resident Commissioner, whose experience extends over a period of 34 years, in which the opinion is expressed that little, if any, under-nourishment exists among the Swazi. The Agricultural Officer agrees with this statement and both are strongly impressed with the "quite extraordinarily healthy appearance" of the Swazi. This view is somewhat at variance with the facts brought out by the Medical Officer and referred to in paragraph 3 below. Additional information taken from "Notes on the Diet of the Swazi," by Mrs. Kuper, has been incorporated in this summary.



2. *Composition and Nutritive Value of Dietary.*—The staple diet is maize, either green or matured, eaten mostly in the form of porridge. The diet is supplemented by sour milk, pumpkins, sweet potatoes, beans and very occasionally by meat. It is reported to be ill-balanced and monotonous, being too high in carbohydrate, too low in protein and deficient in vitamins. A redeeming feature is the amount of milk consumed, especially by children, either in the natural form or as amazi (sour milk). Unfortunately, this habit seems to be discontinuing in favour of sending milk to the creamery for butter manufacture. A factor of importance is the seasonal variation in the food supply available to the native in his home surroundings. For some months abundance is available; at other times even the richer class of native has difficulty in obtaining sufficient food.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—*Adults.*—At first sight the average adult appears healthy and well nourished. That the average native dietary is capable of improvement, however, is obvious from the fact that hospital patients and prisoners on institutional diets invariably put on weight. In a recent examination of hospital out-patients 8 per cent. appeared to be undernourished, 80 per cent. of whom were women. Compared with the average ration of the native in his kraal, institutional diets are approximately 20 per cent. higher in calories and are richer in protein and vitamins.

*Children.*—Evidence of malnutrition among children is more obvious. Over 80 per cent. of babies showed signs of nutritional disorder in a recent out-patient department examination. Although accurate figures are not available the consensus of medical opinion is that infant mortality during the first year approximates 40 per cent., half of which die within the first two months. This is largely due to irregular breast feeding and the custom of feeding babies on sour porridge during the first week of life. The excess of carbohydrate and lack of vitamins in the average diet leads to much intestinal trouble and impaired resistance to disease. Every year cases of scurvy are noted among children, these being particularly numerous in 1936. Its prevalence varies with the nature of the season. In the Southern District children are anaemic, poorly nourished and suffer from recurrent attacks of malaria. Following a period of drought and want, malaria always takes a more serious and fatal form.

4. *Economics of Diet (in relation to local agriculture, cost, tariffs, etc.).*—The Swazi natives grow about one-quarter of the foodstuffs required for consumption, the remainder being for the most part produced by European farmers while a little is imported. The average yield per acre of native land is about

one-half that of land owned by Europeans. The great importance attached to the number of cattle in assessing wealth tends to decrease the amount of land cultivated.

5. *Researches and Surveys*.—No detailed dietary survey or extensive research has been carried out; but samples of local foodstuffs have been examined for vitamin content by Dr. Fox at the Institute of Medical Research at Johannesburg. An unexpectedly high anti-scorbutic power was found in a large number of them, especially in the succulent tops of many herbs used as spinach.

6. *Practical Measures for Improvement of Nutrition*.—The following are the directions in which it is hoped to effect improvement in nutrition: child welfare work; increased hospital facilities; improved land cultivation; extended cultivation of protein-rich foodstuffs such as groundnuts instead of so much maize; the planting of fruit trees; and the development of storage facilities against times of scarcity.



## EASTERN.

## ADEN COLONY.

*Area*: 75 sq. miles.

*Population*: 45,992 (1931).

*Birth Rate*: 32.07 per 1,000  
(1937).

*Infant Mortality*: 196.61 per  
1,000 births (1937).

*Death Rate*: 31.72 per 1,000  
(1937).

1. *General*.—No standing nutrition Committee has been appointed; but a comprehensive preliminary survey by the Senior Medical Officer of the Colony has been submitted. This survey deals primarily with the 75 square miles of volcanic rock and sand which constitute the Colony of Aden; a detailed review of the nutritional affairs of the Protectorate has been postponed until a later date. The Colony is almost entirely urban and so cosmopolitan in make-up as to complicate the task of reviewing the nutritional conditions as a whole. Arabs, Jews, Somalis and Indians of various races predominate, and a preponderance of males is occasioned by the fact that those who come to Aden for varying periods of time to seek livelihood as coolies or tradesmen leave their womenfolk behind in the interior or in India. The natural division is to classify Arabs, Jews and the poorer classes of Indian Mohammedans as the indigenous population and it is to these, particularly the middle and lower classes, that the present nutritional considerations mainly apply.

2. *Composition and Nutritive Value of Dietary*.—All the chief articles of diet are, with the exception of fish, imported from overseas or from Arabia. They are: rice, flour, sugar; fish, mutton, beef, goats' milk, eggs, ghee; fruits, vegetables, dates, lentils, simsim oil, tea, coffee and spices.

Rice, of varying quality but always milled, is imported from India and the East. It is the foundation of the mid-day meal at which it is eaten together with cooked fish or meat. Flour comes in large quantities from India and Australia. That used both by Indians and Arabs for chapatties is the Indian variety known as "atta" which retains most of the essential parts of the wheat grain. White flour is used extensively for bread making. Jowari (*Sorghum vulgare*) is imported from the Protectorate and ground into flour; but its use is not so general as that of flours imported from overseas.

Of animal foods, fish is the most constant item, especially in the diets of Arabs and Jews. All varieties from sprat to shark abound in local waters. Mutton, imported from British Somaliland, is of excellent quality and has a high fat content. The bulk of imported beef is earmarked for ship chandlers; the local

consumption (mainly by Jews) is small and scarcely merits mention. The supply of milk for the poorer classes is derived from goats which live in or around the dwelling houses. Cows' milk is also sold; but is relatively expensive and insufficient in quantity to meet the needs of the whole population even if they could afford to buy it. There is a certain amount of goats' milk available, but the supply and quality vary with the amount of green fodder available. Owing to frequent scarcity of green fodder (which is procured from the interior) the goat has to rely on poor quality hay supplemented with such extras as it can pick up in the streets or off garbage heaps. Mainly, it is thought, as a result of missionary education, the custom has developed of boiling all milk given to children. This may provide a much needed safeguard against bacterial contamination, but the question arises whether or not its nutritive value may be unduly impaired in the process. The consumption of milk *per caput* is small.

Vegetables, mostly of the European type, are produced in the garden owned and controlled by the settlement and are retailed in the markets to the public. Pumpkins, water melons, cucumbers, spinach, bringals, lady's fingers, cress, tomatoes, potatoes, onions and various herbs are usually available and are cooked as a separate evening dish or added to fish and mutton dishes. Dates are not a regular dietary item in the average Arab family, but are largely consumed by the coolie class and by Somalis.

In general, the dietetic régime would be fairly sound if adequate quantities could be guaranteed for all. Unfortunately, however, quantitative deficiency in the poorer classes is a serious consideration. As the social scale descends the diet becomes quantitatively and qualitatively poorer, a fact which is reflected in the extent of deficiency disease in the poorer classes, particularly among children.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—On the whole, Aden can boast a high standard of public health. The greatest drawback is overcrowding. Large families occupy inadequate and ill-ventilated accommodation in which, as often as not, the domestic goat also claims a quota of space. In consequence of these conditions, respiratory and alimentary diseases are all too common. Diseases directly attributable to qualitative dietary deficiency are not a prominent feature of hospital returns in Aden and the more classical of the tropical deficiency diseases—beriberi, scurvy and pellagra—do not occur. Evidence of qualitative deficiency is found, however, in the incidence of rickets among children and of certain eye infections. An examination of 527 unselected children (consecutive cases treated in the Civil Hospital) showed that 33, or 6.2 per cent., were suffering from rickets.



Although most of these cases were mild and without gross deformity, their occurrence indicates that all is not well with the diet, mode of living or both. The most common eye conditions met with are the various forms of conjunctivitis, and keratitis. These yield rapidly to administration of vitamin A as cod liver oil. Xerophthalmia and keratomalacia are uncommon; but night-blindness is frequently found among adults. Other facts worthy of record are the heavy incidence of intestinal and bronchial affections. Urinary calculus, too, is the cause of much invaliding and points to deficiency of vitamin A and of animal protein.

Data in regard to physical standards in relation to nutritional status are almost entirely lacking. The Arab is of slight but stocky build averaging 5 ft. 9 ins. in height and turning the scale at 105-115 lb. with, as a rule, a well developed musculature. The Jew is slimmer and taller, and light in proportion to his height; in physique he is inferior.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The peculiar local topography precludes the Colony from producing its own natural foodstuffs. The fishing industry and the local production of milk and eggs are exceptions to this general rule; and it is true that there are possibilities of a limited agriculture on the oasis of Sheikh Othman and at Hiswa. But the main source of supply must remain, as it has always been, imports from Arabia and overseas. Aden is a free port and therefore prices of essential foodstuffs are not raised by customs charges. An efficient marketing system with minimal dues makes fresh meat and vegetables readily available.

The relationship between purchasing power and food consumption is noticeable. As a rule labour supply is in excess of demand and wages are low. Moreover, the demand for food depends entirely on earnings, for labour is irregular. Consequently as the labourer has no other resources, the individual daily diet is too frequently below actual requirements.

5. *Researches and Surveys.*—On account of the relatively small size of the Colony, its cosmopolitan population, and the fact that the bulk of the essential foodstuffs are imported, it is considered inadvisable to embark on any elaborate local scheme of investigation. Data from other sources where conditions are similar would provide an adequate guide for the correction of the more obvious dietetic errors and deficiencies which occur.

It is recommended that for the present further study and research be confined to the compilation of reliable vital and anthropometric statistics including an accurate estimate of the degree of malnutrition which exists, its type and its incidence among the various racial and social groups. At the same time a closer

examination of the customary diets would be made. This work can be handled by the existing staff of the Government Medical Department working in conjunction with the Health Authorities of the Aden Settlement.

6. *Practical Measures for Improvement of Nutrition.*—In the past, practical measures with a bearing on nutrition have been mainly indirect, *e.g.* the maintenance of a free port and absence of tariffs on imported foodstuffs. Various endeavours have been made to introduce some form of poor-relief into the Colony and at present a very small fund operates through which cash payments are made to a few poor people. Endeavours are being made to organize this system on an extended and permanent basis.

Child welfare and maternity work has progressed slowly in the clinic attached to the Civil Hospital and through the Keith Falconer Mission of the Church of Scotland. Future expansion of these services is envisaged by means of a fully equipped and adequately staffed Maternity Centre of which Government has already guaranteed the maintenance. It is hoped that public subscription on the occasion of the Aden Centenary will provide a suitable building.

In regard to the expansion of agriculture the main difficulty is one of water supply. In the oasis of Sheikh Othman (see paragraph 4), all cultivation is entirely dependent on artificial irrigation for which the only water really suitable is the deep bore system which constitutes the main settlement supply. Formerly an undeveloped type of agriculture existed on irrigation from shallow wells too brackish for general purposes. It is recommended that this be re-investigated with a view to discovering whether certain fruits, vegetables and animal fodders could not be produced by this means, thus increasing local supplies at a price competitive with that of imported articles.

A practical suggestion in respect of milk supply is that the Aden Settlement should provide free, or at low cost, pens for goats at various points in the Settlement, when milk could be distributed for sale at a controlled price. If such were adopted as a municipal enterprise a fair supply of fodder might be made available by extension of cultivation in the Settlement gardens, and any loss of revenue, or actual expenditure involved, would be amply compensated for by the popularisation of an article of diet so essential for the growing population.



## MALAYA.

(STRAITS SETTLEMENTS; FEDERATED AND UNFEDERATED MALAY STATES.)

*Area*: 50,997 sq. miles.  
*Population*: 4,660,215.

*Birth Rate*:\* 44·33 per 1,000  
 (1936).

*Infant Mortality*:\* 170·85  
 per 1,000 births (1936).

*Death Rate*:\* 24·91 per  
 1,000 (1936).

\* Straits Settlements only.

1. *General*.—A Committee representative of the Departments of Education, Agriculture, Medical Services, Veterinary Research, together with the Director of Co-operation and the Registrar-General of Statistics, has been set up. The interim report of this Committee has been received, and includes the following: (a) a review by Dr. Rosedale (Professor of Biochemistry, College of Medicine, Singapore), (b) notes on the incidence of dental caries in Malaya by Professor Tratman, (c) report on dietary standards in Kedah by Dr. Strahan, (d) report on nutrition among Malays in coast districts by Dr. Burgess, and (e) summary of reports on deficiency disease among prisoners.

It is important to remember that Malaya is primarily a rural country. Its population may be roughly divided into:

A. *Chinese*:

(a) those working and eating singly or in small groups, *e.g.*, town dwellers and retail shopkeepers throughout the country;

(b) those working and eating in larger groups, *e.g.*, labourers on estates and mines.

B. *Malays*: almost all small agriculturists or fishermen.

C. *Indians*:

(a) shopkeepers in towns;

(b) labourers on estates.

2. *Composition and Nutritive Value of Dietary*.—As a result of extensive work by Rosedale there now exists information regarding the composition and relative values of Malayan foods. The available food supply in towns is wide and varied and the means to rectify any possible deficiency are at hand if only the people had the resources to buy and the knowledge to make the best use of the present supplies. In remote country districts the case is different and enquiry is still necessary to ascertain precisely what foods are available there.

Rice is the most important food (see below) and is supplemented with vegetables of the root variety, leaves and pulses. The red unbleached palm oil produced in Malaya makes an excellent substitute for the usual vitamin A containing foods. Fish is the only animal food which enters into diets to any extent. Very little milk is drunk although recently there has been a tendency to increased consumption in rural areas, but of tinned, not fresh milk. Meat is rarely eaten, and eggs infrequently, but more so by inland than coastal Malays.

The Committee finds that, in general, the main deficiencies are of B-vitamins and protein. Although the Chinese eat considerable fat of kinds poor in vitamin A, the diets of most other people are fat deficient, and in the Kedah survey people were found whose food intake was little greater than that required to supply the very minimum energy requirements of the average Malay in the south.

*Rice.*—Special consideration has been given to the nutritive value of rice. In rural areas most of the inhabitants eat the locally grown rice (padi) prepared by hand. In other parts, the rice sold in shops is usually polished and washed, and thus devoid of any vitamin whatever. One satisfactory rice is that prepared by the Government rice mill at Bagan Serai, which is husked but not polished or only slightly so. The striking superiority of this husked rice has been proved by animal experiments and it would appear better to live on a poor man's diet with husked rice as the basal cereal than upon a supposedly better class diet with white rice as the basis.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Beriberi xerophthalmia and other gross deficiency diseases are not infrequently reported. Physique and stamina appear to be inferior when judged by European standards. In regard to weight, for example, it has been found that Chinese are 18 per cent., Malays 13 per cent., and Eurasians 10 per cent. below European standard at 16 years of age. But a more important point is that for the first six months of life the weight of children coincides with European standards. It is only after weaning and the transference to white polished rice unsupplemented with milk that the drop occurs. From the Kedah survey, too, it appears that in remote rural areas some 60 per cent. of children are below par, two-thirds of whom are in dire need of extra nourishment. The situation in the more prosperous coastal and rubber areas is less serious, although here also 40 per cent. of children are below par. This survey also reveals the fact that, in general, the diet of the Malay is deficient in energy value, in first class protein, and in the B vitamins. The rural people, especially,



live on the "verge of safety", and consequently, any unusual demands upon the slender stamina tend to produce some form of deficiency disease.

There is evidence that general disease resistance is lower in immigrant Indians than in Malaysians or Chinese. The factor of safety in the Malay diet appears to be the fresh natural produce grown by the peasant on his own smallholding although a reduction in the number of these home vegetable plots goes hand in hand with improved economic conditions. As purchasing power increases the cultivation of vegetables is considered less and less worth the trouble involved. The same considerations apply to the consumption of rice. An increasing death rate from beriberi is coincident with improvement in general prosperity the explanation being that higher purchasing power makes it possible to indulge the preference for the more expensive highly polished rice instead of the unpolished home-grown variety.

Nutrition in relation to malaria and hookworm infestation is also considered at some length and it appears that even where the incidence of these diseases is high the physique of children getting good diets may be better than that of children in districts of low incidence but having poorer food. In the section dealing with prison diets the interest lies in the fact that the diet rejected on account of its deficiencies was based as nearly as possible on the home diet of the prisoners. The deficiency diseases which developed were counteracted by the substitution of unpolished for polished rice, and by the addition of green vegetables. In general, it may be said that the incidence of dental caries is from 70-95 per cent. and that it is higher in urban than in rural areas. It is presumed that the more sophisticated and less wholesome foods obtainable in the towns and the extensive hawking of sugary cakes and sweetmeats in schools are the factors primarily responsible for the extent of dental decay seen among urban children.

Some two-thirds of the labourers employed on estates in Malaya are Southern Indians and of these the vast majority are Tamils, others being Telugus and Malayalees. All are emigrants or descendants of emigrants from the Madras Presidency. Wages and living standards are higher than in Madras, but, unfortunately, just as in the case of the Malays mentioned above, increased purchasing powers frequently mean reduced cultivation of fresh foodstuffs. Moreover, the change from a village to a plantation environment renders it almost inevitable that a bigger percentage of their foodstuffs must be bought. Every estate is, of course, required by law to set aside land for allotments (one-sixteenth of an acre for each labourer who has dependents) but these are not always taken advantage of owing

to the natural disinclination of the labourer to spend a considerable part of his leisure in cultivating gardens when his wages enable him to live in reasonable comfort without recourse to his allotment.

The basis of the diet of the Southern Indian is parboiled rice supplemented with dhall, spices and coconut oil. Dhall is a mixture of the husked and split seeds of numerous grams and pulses. The spices they use include capsicum, cardamons, coriander, cinnamon, turmeric and pepper, all flavouring agents of low nutritive value. Coconut and sesame oils are the main sources of fat. Additions to this basis are haphazard, varying widely with the food resources of the district and the saving habit of the individual (the Telugu, in particular, being over-inclined to frugality)—vegetables, mostly tubers, two or three times a week, dried fish once or twice a week; goat flesh on high days and holidays; tinned milk; tinned fish occasionally and eggs once in a while. Large numbers of labourers rear cattle or goats and many grow their own vegetables, while others, particularly in the coast districts, become expert fishermen. When markets are near, some purchase fresh vegetables and fish or meat to supplement their rice and curry, but there are others who, either from want of facilities or from want of enterprise, depend far too much on the dried and parched miscellany of the estate shops.

South Indians have two principal meals a day—at noon and at sundown. Most labourers' wives do field work to swell the family income, so food is prepared in the afternoon after the day's work is completed. Each family has its own cooking arrangements and there is little attempt at variety. Analysis of the diets consumed suggests that they are not well balanced. The protein standards are low; protein of good quality, meat, fish, milk, eggs, is deficient. The fat is almost entirely of vegetable origin, and fat soluble vitamins A and D probably below optimal requirements. Supplementary sources of vitamin A, leafy vegetables and carotene-containing tubers are often absent.

Associated with these deficiencies, possibly correlated with them, are low physical standards, poor stamina, susceptibility to bacterial disease and the occurrence of clinical evidences of lack of vitamin A, xerophthalmia and night blindness. Clinical deficiency of vitamin B is almost unknown, and of the vitamins C and D rare; vitamin B is fully provided by the rice and dhall of the diet, vitamin C by occasional fresh fruits and tubers, and vitamin D by the sun.

Chinese labourers are an important section of the community. More than 80 per cent. of the labour employed on mines and in factories and more than 20 per cent. of the estate labour in Malaya is recruited from Chinese emigrants—mainly from the southern maritime provinces of Kwantung and Fukkien.



All but a few are of one of the five tribes Cantonese, Kheh, Hokien, Tiechew and Hailam, mostly of the first two. Their diet in Malaya follows the traditional dietary of Southern China as closely as circumstances permit. They produce for themselves the foods to which they have been accustomed, if soil and circumstances allow, or else, failing this, import them from China. They are extremely conservative and show little disposition to adopt the food customs of the other races with whom they come into contact.

The basis of this diet is rice and the main supplements vegetables, beans and pork. The rice is polished and of pleasing appearance but inferior in quality from the loss of vitamins and mineral salts produced by excessive milling. The distinctive features of the diet are the high consumption of vegetables, the importance of soya bean and the inclusion, whenever means permit, of fat pork. The Chinese are the vegetable gardeners of the Malay Peninsula. They cultivate for the market and for their own consumption a wide variety of leafy vegetables, tubers, pumpkins and gourds, and moreover import large quantities of dried and salted vegetables from China. Soya bean, and bean sauce, bean curd and bean paste, foods derived from soya bean, are constant additions. Pork is the main source of animal protein. Most labourers buy pork as often as they can afford it and fry their vegetables in the fat. Either pork or dried fish probably enter the daily diet of most labourers who are in employment. Milk has no place in the diet. Eggs, mostly duck eggs, poultry and fresh fish are occasional luxuries. Additions of fruit depend on circumstances.

When times are good most Chinese labourers feed themselves very well. Many indeed spend most of their wages on food, for they are not of the saving habit of the Tamil labourer. It is said that their food expenditure is often double that of the Tamil. The preparation of food is a matter for careful attention. Most "kongsis" or groups of labourers employ a cook. Food is well prepared and cooked and served in an appetising manner. Meals are looked on rather as a social occasion. Like most Orientals, they have but two main meals a day, early morning and evening, with an occasional interim meal in the middle of the morning of rice water with a little fried vegetables or a sweet made of sugar and bean flour. Typically the main meals consist of a bowl of boiled white rice with pork or dried fish and a generous addition of vegetables and beans fried in groundnut oil or pork fat.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Beyond the references in the preceding paragraph to economic conditions and purchasing power there is little for further comment under this head. Research is necessary on the economics of a well balanced diet under urban, estate and mine conditions and to ascertain the minimum acreage of rubber, coconuts, padi, etc. necessary at given prices to enable a family to secure an adequate diet.

5. *Researches and Surveys*.—Laboratory research is being actively prosecuted at the King Edward VII College of Medicine, Singapore, and at the Institute for Medical Research, Kuala Lumpur. The factors of time and expense demand that clear limits should be set to these studies and, though possibly of very great importance, academic studies are being postponed till problems of more immediate practical importance have been solved. In addition to the researches which form the basis of the conclusions reached in the preceding paragraphs, much work has been done on basal metabolism in the tropics, work which it is proposed to extend. It has been found that the average Asiatic inhabitant of Malaya has a basal metabolism about 10 per cent. lower than that of the normal European. Further, it appears that the basal metabolism of the European becomes lowered in Malaya and can be raised by leave in Europe and even by local leave at a hill station. Accordingly, it would seem that climate is a more important factor than race in determining the basal metabolic rate.

6. *Practical Measures for Improvement of Nutrition*.—It is Professor Rosedale's opinion that while Malaya spends much time and money in securing scientific knowledge, comparatively little use is made of it because until further field surveys have been carried out it is difficult to judge what to apply. The Standing Committee apparently concurs in this view inasmuch as they state that while their report may be taken as reasonably accurate so far as present knowledge goes, much further investigation is necessary before any useful recommendations can be made with a view to putting into effect a co-ordinated nutrition policy. The main difficulties to be faced are the inability through poverty of the great majority of the people to supply themselves with the requisite articles of diet and the difficulty of persuading them, especially the Chinese, regarding the advantages of undermilled rice. The health services have made considerable efforts towards improving nutrition, and an enthusiastic response has been made to their scheme for disseminating information through the schools.

#### NORTH BORNEO.

*Area*: 29,347 sq. miles.

*Population*: (Census, 1931).

Natives of North

Borneo ... 205,218

Chinese ... 47,799

Other Races ... 16,612

Europeans ... 340

Total ... 269,969

*Birth Rate*: \* 26.8 per 1,000 (1937).

*Infant Mortality*: \* 163.3 per 1,000 births (1937).

*Death Rate*: \* 25.2 per 1,000 (1937).

\*Certain districts only.



1. *General*.—(a) The natives of Borneo comprise 76 per cent. of the total population and consist of five main groups: Dusuns, Muruts, Bajaus, Bruneis and Sulus.

*The Dusuns* numbered 117,482 at the last Census in 1931, they are of short but sturdy build, and are a peaceable and law-abiding race, with a strongly developed agricultural instinct. They may be looked upon as the farmers of the country: they produce most of the padi (rice) grown and are also successful growers of native tobacco. The Dusun population is mainly located on the north and west coasts, and at Tambunan in the Interior.

*The Muruts* numbered 24,444 at the last Census, and inhabit for the most part the hills of the interior. They are excellent hunters and subsist mainly by hunting and bartering jungle produce.

*The Bajaus* numbered 34,099 at the last Census. They are Mohammedans and are established in villages along the coast, and on the islands from Caya Bay to Cowie Harbour; in the Tempassuk district their settlements extend considerable distances inland. The average Bajau swims like a fish and is an intrepid seaman. He earns a precarious livelihood by fishing, collecting sea produce and making salt.

*The Bruneis*, numbering 21,112, are Mohammedan immigrants but have firmly established themselves along the coast and up the rivers from the Brunei border as far as Papar. They practise agriculture, but are chiefly known as boat builders.

*The Sulus*, of whom there are 8,081, are also Mohammedan immigrants or the descendants of immigrants from the Sulu Islands and their settlements are to be found along the east coast. Like the Bajaus, they are a race of sailors and their chief business is fishing and the collection of sea produce.

(b) *The Chinese population*.—The Chinese in North Borneo, 47,799 in number, fall into five groups, the coolie class; the servants; the farmers and market gardeners; the small shopkeepers and traders; and the merchants.

2. *Composition and Nutritive Value of Dietary*.—Wet rice is the staple diet of the native at Tambunan in the interior and in the district of the west coast. Tapioca and dry rice form the staple food among the hill natives. Other crops more or less common to most districts are maize, sweet potatoes, marrows, gourds, cucumber, egg-plant, bananas, papaia, pomeloes, limes, oranges, pineapple, mango, durian, keladi, chillies, bamboo shoots and fern tops.

The principal domestic animal of the native is the water buffalo, or *kerbau*, which is found throughout the country, except in the hilly Murut districts. This animal is called upon to

perform the functions of hack, hunter and heavy draught; once broken in it is equally tractable whether being ridden to market by its master, whether it is taking part in a deer hunt, pulling a native bamboo sledge, or dragging a plough through a muddy rice field. It has its uses in death as a substitute for beef, but is only killed by the natives themselves on feast days.

Native cattle are numerous in many parts of the country, especially at Papar, Tempassuk and Keningau. They do not, however, receive the same attention as the water buffalo and they are allowed to roam wild over the plains unless they are rounded up for sale.

Pigs and goats are seldom slaughtered for food by the natives except on special occasions. Fresh milk and its products are not utilized at all.

From data obtained in assessing the nutritive value of both the Murut and Dusun diets, it appears that the calorie requirements are met but animal protein and fat are deficient and the amount of carbohydrate more than necessary for normal requirements.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The staple diet of the native of North Borneo is whole rice or tapioca, and beriberi, in consequence, is rarely seen among the native population. On the other hand among the immigrant Chinese labourers working in isolated timber camps on the east coast, where polished white rice is the staple food, beriberi frequently occurs especially after heavy rains which destroy the camp vegetable gardens. Endemic goitre occurs in the hilly regions; in the Bokan country 33·6 per cent. of 1,014 natives examined were found to be affected.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—No information on the minimum cost of adequate nutrition for the native population is available. All foodstuffs are grown by the natives themselves, on their own land, and small luxuries are obtained by means of barter at native markets. On the other hand 99 per cent. of the food of the immigrant Chinese is imported, and the minimum cost on which a Chinese labourer can live is from \$4·50 to \$5·00 per month (\$=2s. 4d.).

Cattle, including sheep and goats, may be imported free and the import tariff on rice is suspended. The tariff on bean oil is 4 cents per catty (1 catty=1½ lb.) and 10 cents per catty on coconut oil in order to stimulate local manufacture. On butter of British origin the tariff is 5 per cent. ad valorem and 15 per cent. in the case of foreign origin.

5. *Researches and Surveys.*—In 1936, Dr. J. O. Shircore, C.M.G., late Director of Medical Services, Tanganyika Territory, spent 12 months in investigating native health in the interior



and west coast of North Borneo with special reference to the sociological and economic factors bearing on the depopulation problem of the west coast and interior.

6. *Practical Measures for Improvement of Nutrition.*—Among the recommendations made as a result of the survey referred to above were the formation of a malaria research unit at Tambunan, the institution of maternity and child welfare centres, the training of native sanitary inspectors and the expansion of the subordinate medical staff. Schemes to give effect to the first three recommendations have already been prepared and the first batch of native sanitary inspectors will complete their training in December this year. Arrangements have also been completed by Government for the examination and treatment of vernacular school children by a dental surgeon. All children attending the vernacular schools are examined twice yearly by a medical officer; they are also examined twice yearly for hookworm infection and treated if found to be infected. Children attending mission and private schools in the towns of Sandakan and Jesselton are also examined twice yearly for hookworm infection and treated when found infected. The infection rate among these children has decreased from 71 per cent. in 1924 to an average of 5 per cent. during the past five years. An attempt to stimulate the interest of vernacular school children in milk has been made in Sandakan during the past 12 months by the free issue of seven ounces of milk daily to 30 selected children over given periods of time.

## SARAWAK.

*Area:* 50,000 sq. miles.

*Population:* 443,000.

*For Kuching only (1936).*

*Birth Rate:* 32·8

*Infant Mortality:* 232·5

*Death Rate:* 24·9.

*General.*—There is a Chinese population of upwards of 100,000. The remainder of the population is made up of Malays, Dyaks and a number of miscellaneous tribes. Rice is the staple food both of immigrant Chinese and of the native population. Imports amount to anything up to 32,000 tons a year, and there is considerable local production. Other food crops include soya beans, millet, yams, maize, groundnuts and sugar cane. There is no doubt that the increased demand for labour on rubber gardens is causing a number of Chinese and natives to abandon padi cultivation in favour of rubber tapping. Numbers of cattle, goats, etc., are kept by the natives but there is no organised industry. Butter and ghee are produced locally.

## HONG KONG.

|                                     |                   |   |
|-------------------------------------|-------------------|---|
| <i>Area:</i>                        |                   | <i>Birth Rate:</i> 32.1 per 1,000<br>(1937).      |
|                                     | <i>sq. miles.</i> |   |
| Island ...                          | 32                | <i>Infant Mortality:</i> 361 per<br>1,000 births. |
| New Territories                     | 358               |   |
| Total ...                           | 390               | <i>Death Rate:</i> 34.4 per 1,000<br>(1937).      |
| <i>*Population (mid-year 1938).</i> |                   |   |
| Non-Chinese ...                     | 23,096            |   |
| Chinese ...                         | 1,005,523         |   |
| Total ...                           | 1,028,619         |   |

\*Estimated on arithmetical basis utilising intercensal increase between 1921 and 1931. No account is taken in this estimate of the temporary increase due to the influx of between 200,000 and 250,000 refugees from disturbed areas in China.

1. *General.*—The population of Hong Kong is concentrated into the urban districts of Victoria and Kowloon and into a few minor townships such as Cheung Chau, Taipo and Un Long in the New Territories. Less than 10.6 per cent. live in rural areas.

According to the Census of 1931 some 42,000 persons were engaged in agriculture. In addition, a certain proportion of the maritime population, estimated approximately 100,000, is engaged in fishing enterprise.

By far the greater number of the inhabitants of the Dependency are employed in industrial undertakings, in transport, engineering, building, public works, domestic service, etc.

2. *Composition and Nutritive Value of Dietary.*—Rice is the staple diet of the Chinese inhabitants. With the exception of a small amount of red rice consumed in the rural areas, white rice is almost exclusively used. Locally produced rice, especially that from the Shatin Valley in the New Territories, has for centuries been held in such high esteem in parts of China as far distant even as Peiping, that it is largely exported and cheaper rice imported from Burma, French Indo-China and Siam for local consumption. This rice diet is augmented where funds are available by small quantities of beans, vegetables, ginger, meat, fresh, dried or salted fish and by fresh or salted eggs; but the lowest wage-earners are able to buy very little of these additional foodstuffs and milk is almost unknown amongst the really poor.



3. *Diet and Health (deficiency diseases and other relevant considerations).*—The situation has changed considerably in the last two years.

This may be due partly to the considerable influx of refugees into the Colony resulting from the outbreak of Sino-Japanese hostilities in 1937. Although such diseases as rickets, pellagra and scurvy are rarely encountered in Hong Kong, beriberi is responsible for a heavy toll of suffering and death, and there is little doubt that a proportion of the large number of cases and deaths in infants from enteritis is attributable to faulty feeding and malnutrition in some form or other. In this connection, it might be interesting to note that some 1,661 deaths were certified as being due to beriberi out of a total of 34,635 in 1937 and that a further 2,365 infants under one year died of enteritis. The fact that beriberi is common amongst the poorer inhabitants of both sexes and of all ages in Hong Kong can be easily established by visiting the Chinese Hospitals. No difficulty, for example, was experienced in May, 1938, in discovering 150 in-patients suffering from beriberi in a group of three Chinese Hospitals when steps were being taken to relieve, in part, the overcrowding existing in them and it was desirable to transfer such curable cases to a temporary hospital.

Moreover, observations carried out on women at the Tsan Yuk Maternity Hospital by Dr. W. C. W. Nixon, Professor of Obstetrics and Gynaecology, University of Hong Kong, in 1936-7, lent further support to the belief that malnutrition and signs of definite deficiency of vitamin B<sub>1</sub> were present in a proportion of the Chinese women cared for at this institution. Again, the investigations in 1937 by Dr. L. T. Ride, Professor of Physiology, University of Hong Kong, on the oedema found in cholera cases strongly suggested that a *prima facie* case existed that the condition was due in part to some type of malnutrition. This research work was made possible by a grant-in-aid of \$500 from Government. The high incidence of pulmonary tuberculosis and of diseases of the respiratory system generally may perhaps serve as yet another possible indication of the existence of some degree of malnutrition amongst the community.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Although food prices are comparatively low in Hong Kong as compared with those prevailing in many other parts of the world, the average daily earnings of members of the labouring class are also low and rentals are high for the standard of accommodation usually provided. Since only a very small proportion of the total food supplies concerned in the Colony is home-grown, it is fortunate that Hong Kong is, practically speaking, a free port and that no customs duties are payable in respect of imported foodstuffs.

5. *Researches and Surveys*.—Useful work has already been carried out by the members of the Nutrition Research Committee and has been briefly referred to in section 3 of this summary.

In the view of the Director of Medical Services, there are ample grounds for further research and survey being undertaken locally, although he considers that such research work and surveys should not be of a laboratory character but should take rather the form of field work.

The actual plan of campaign will be decided upon by a newly constituted and enlarged Nutrition Research Committee under the Chairmanship of the Director of Medical Services after the receipt of information from Professor Rosedale of Singapore as to which portions of the proposed programme of work have already been effectively studied and reported on by him in the Straits Settlements. This should help to obviate any unnecessary overlapping of investigations in the two countries.

In co-operation with the Commissioner of Prisons and the Superintendent, Botanical and Forestry Department, it is planned to carry out experiments locally on the production on a large scale of alfalfa (*Medicago sativa* L.) and of the true and Chinese spinach (*Spinacea oleracea*, L. and *Amarantus Blitum*, L.). Alfalfa has been grown on a small scale in these territories since 1922, and special seed was obtained from Australia in 1936 which produced a good crop. The actual scale of both experiments was, however, rather too small to be of general value.

Mention should also be made of three factors having a bearing on the subject under discussion.

(a) A Housing Committee appointed by Government has issued a report—which deals, *inter alia*, with the question of economic rentals.

(b) A group of local volunteer welfare workers has carried out a housing experiment on a settlement basis and in the face of considerable difficulties, and has issued a report. The proportion of income spent on rent as compared with that available for the purchase of food has, of course, an important influence on nutrition.

(c) The Government has decided to appoint a Labour Officer to investigate cost of living, wages, conditions of work, etc.

6. *Practical Measures for Improvement of Nutrition*.—In consultation with the Professor of Physiology, new dietaries have been devised by the Government Medical Department for prisoners in the Hong Kong prisons. Similarly, the diet of parturient women in the Government Tsan Yuk Maternity Hospital has been varied by direction of the Director of Medical services as the result of discovery of symptoms of beriberi in a



certain proportion of the patients. Free meals are being supplied daily to nursing mothers and young children attending the two welfare centres in Hong Kong and in Kowloon on the mainland. About two hundred mothers and children are assisted in this way. The Hong Kong Society for the Protection of Children assisted at the Welfare Centres by supplying milk foods free for distribution among deserving cases. The Society and the Welfare Centres also assisted mothers by giving them letters which enabled them to buy condensed milk at cost price from certain retailers. Two charitable organisations have also established food distribution centres, one for destitutes and two for destitutes and refugees. The dietary consists of rice, beans, green vegetables, tomatoes and, to younger children, skimmed milk (ordinary full-cream milk being too high in price for the numbers catered for). About 2,000 persons, including many women and children receive one good meal a day at these food distribution centres. Occasional checks were made by Medical Officers with regard to the general and nutritional condition of those attending the food distribution centres. These somewhat hurried surveys have disclosed definite signs of malnutrition in 31.44 per cent. of those attending. Plans and estimates have been drawn up for establishing another welfare centre at the old Government Civil Hospital and at Health Centres to be established on the Island, in Kowloon, New Kowloon and Kowloon City and in the New Territories should funds be available. It is the considered opinion of those who have studied the problem that Welfare Centres provide the best means of educating the less fortunate (but by far the larger) section of the population in the way in which the rising generation should be brought up and more especially, in the most suitable dietaries for babies, young children and expectant mothers. It is believed that a vast amount of sickness and suffering could be prevented were even more facilities available for this work. It should be remembered that a mother who has received adequate instruction at a Welfare Centre is not only in a position to put the principles she has learnt into practice in her own family circle, but also helps to propagate such knowledge in the tenement or street in which she lives. Radio talks have been broadcast and published in the English and vernacular press on the feeding of infants and children, on diet in relation to teeth, and on kindred matters. The importance of pure milk has been brought home to the general public and legislation has been enacted making the pasteurization and clean bottling of milk compulsory from the 1st of January, 1939. Efforts have been made to encourage large producers of milk to transfer their farms to the mainland where their herds of cattle can be expanded considerably in numbers. Attempts have also been made to encourage those engaged in paddy farming to undertake dry cultivation of vegetables. It is hoped to be able

to carry out experiments with the cultivation of alfalfa and amaranth both of which are of high dietetic value. The co-operation of the Prisons and Botanical and Forestry Department will be sought in this direction. Finally, in order to counteract the incidence of beriberi as far as possible experiments were made to find a cheap anti-beriberi factor. Rice polishings are obtained locally at a cost of \$12.50 per hundredweight and are used extensively in hospitals and other public institutions.

Hong Kong is for the majority of its population only a very temporary place of sojourn. The annual migration of some 500,000 individuals to and from China leads to great difficulties in effecting permanent improvement in the nutrition of the Colony.

### CEYLON.

*Area*: 25,332 sq. miles.

*Population*: 5,631,000 (1936).

*Birth Rate*: 34.1 per 1,000 (1936).

*Infant Mortality*: 166 per 1,000 births (1936).

*Death Rate*: 21.8 per 1,000 (1936).

1. *General*.—Information in regard to Ceylon is contained in Sessional Paper No. II of 1937, entitled "Report on Nutrition in Ceylon", and in Sessional Paper XXIX of 1937, entitled "Further Report on Nutrition in Ceylon". The Director of Medical Services, who submits the Report states that the major portion is the work of Dr. Lucius Nicholls, the Director of the Bacteriological Institute, Colombo. His main studies were investigation of the diets of children in upper, middle and poorer class schools—the last covering five towns and fourteen districts—and mineral analyses and vitamin assays of all the most commonly used local foodstuffs. These analyses were carried out in London.

2. *Composition and Nutritive Value of Dietary*.—The staple articles of diet are rice, two-thirds of which is imported polished; coconut, usually included in some form in all three meals of the day; leafy vegetables, yams, tubers, beans, lentils, peas, dhals, and gourds, which are made into curries of various types; curry stuffs such as chillies, coriander, saffron, garlic, nutmegs, etc.; and fish. *Upper classes*: the diets consumed by the upper class Ceylonese appear to be a blend of local and European practice and are so well supplemented with other foodstuffs that the evil effects of polished rice do not arise. Nevertheless it would be better if more unpolished rice were used and if much of the meat (meat is used only by upper classes) were replaced by more milk.



*Poorer classes*: here the diets may be summed up as consisting of rice (polished in the wet zones of the south and south-west, and unpolished in rural areas and dry zones of the north), fish, vegetables, coconut and numerous condiments. Fish is the principal foodstuff of animal origin eaten by the poorer classes: meat is rarely eaten and milk and milk products seldom occur in their diets. On the whole the diets in towns are better than those in rural areas; and the diets in the wet zones (S. and S.W.) superior to those in the dry zones (N. and S.E.). The one redeeming feature in the diets of most parts of the dry zone is unpolished rice. Tea is the principal beverage in Ceylon but toddy made from the fermented sap of coconut is also widely used. The toddy yeast which settles out from the supernatant alcoholic fluid is rich in vitamin B complex. Much might be done to encourage the use of this yeast which is as a rule discarded. *Institutional diets* in general use consist mainly of rice, dried fish, very little meat, and some vegetables, according to seasonal availability. They were found by Nicholls to be seriously lacking in vitamins, especially vitamin A.

Analyses and assays show that the most serious deficiencies in the diets of the masses are those of animal protein, calcium, vitamin A and vitamin B complex. To improve the calcium content a greater use of small fish and leafy vegetables is advocated. The amount of vitamin B complex can be increased by the use of dhals and grams, but it will never be adequately supplied until the present vast quantities of imported milled rice are replaced by unpolished varieties such as are to be obtained in many country districts of Ceylon.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Social status to a great extent governs the health and physical condition of the people. Children of the upper classes, whose diets are much superior, are taller and heavier than lower class children of the same age accustomed to much inferior diets. Nicholls has described the prevalence of phrynodema and sore mouth among poorer class children and their association with vitamin A deficiency. This dietary defect is also responsible for the occurrence of blindness which is exceedingly common in Ceylon. At the deaf and blind institute 66 per cent. of cases of blindness were attributable to keratomalacia and xerophthalmia. The high incidence of dental defects and irregular development of teeth is also ascribed to defective nutrition. The excessive maternal and infant mortality is attributed, in part at least, to undernutrition of the poorer classes. Expectant mothers frequently exhibit stomatitis and glossitis (eroded lips and tongue). Rickets is rare in Ceylon; but "mandama" (often somewhat misleadingly translated as "rickets" in official returns) accounts for over 3,000 child deaths annually. Mandama is a multiple deficiency of

vitamins A and B with the following signs and symptoms: stunted growth, xerophthalmia or kerato-malacia, skin eruptions (phrynoderma), pot-belly and wasting. One characteristic feature of Ceylon diets is the excessive use of condiments and spices. Diabetes is very common among upper class sedentary workers and is attributed to gluttony aroused by the stimulus of potent curries which enable the consumption of undue quantities of rice. Cirrhosis of the liver is also exceedingly common and is thought to be due to excessive consumption, not of alcohol, but of highly spiced curry stuffs.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—About two-thirds of all the foodstuffs consumed in Ceylon are imported, mainly in the form of polished rice and pulses. The calorie value of the imported rice allows about 1,400 Calories per man-value per day and that of all other imported foods an additional 250 Calories. Local production, including fish, must amount to less than 1,000 Calories per man unit per day because all the evidence shows that average total calorie consumption does not reach 2,600 per day. The minimum cost of a diet made up of those foods generally eaten in Ceylon, which could be regarded as adequate but not optimal in respect of protein, fat, carbohydrate and total calories, is about 15 cents per day. For a family having a man-value of five, the cost would be 75 cents. Considering that the wages of working classes vary from 40 cents to about Rs.1 per day it is clear that the average wage is insufficient for maintaining adequate nutrition in a family, say, of two adults and five children of ages between two and ten years. Insecure economic conditions of this kind affect a very large number of families in Ceylon.

The question of milk supply calls for comment. The two reasons for the very low milk consumption are insufficient production and prejudice against its use. The total production does not exceed 20 million gallons annually which for a population of 5½ millions allows rather less than 4 gallons per head per year. The poorer classes support their prejudice against milk with the contention that it causes illness—a contention which is probably well founded in view of the highly insanitary conditions under which milk is at present produced.

5. *Researches and Surveys.*—The surveys by Nicholls which form the basis of the report from Ceylon have already been referred to in paragraph 1. Extension of this work is required and to this end the establishment of a special Department of Nutrition is recommended, the functions of which should include: analysis of local foods; prescribing institutional diets; teaching the principles of tropical nutrition; establishment of standards for the inspection of school children; regional and



seasonal nutrition surveys; and co-operation with the Education, Agricultural and other Departments in appropriate measures for the improvement of nutrition.

6. *Practical Measures for Improvement of Nutrition.*—(a) Emphasis is laid on the urgent need for teaching the principles of tropical dietetics and nutrition, not only to medical students in Ceylon but also to medical officers training in the United Kingdom for service in Ceylon.

(b) Instruction on the subject of proper feeding should be given in all schools in the country.

(c) More attention should be paid by the Agricultural Department to the improved cultivation of those local foodstuffs proved by analysis to be of high nutritional value. Leafy vegetables, pulses, yams and sweet potatoes are specially mentioned. The yellow variety of sweet potato is a more valuable foodstuff than the ordinary potato of which over 10,000 tons are annually imported and there appears no reason why sweet potatoes should not be extensively grown.

(d) A greater production and consumption of milk is essential if the poorer class children are to be well grown and energetic. Improved breeding and the better care of cattle should ensure the production of large quantities of milk but there must be strict regulations against adulteration and pollution. Some work has recently been done on the use of curds, which is the principle form in which milk is taken in many parts of the tropics.

(e) The present practice whereby free mid-day meals are supplied in vernacular schools should be extended to cover more and more children. It cannot be too strongly urged that these meals must be adequate and well cooked.

(f) It has been suggested also that Government should consider whether some of the existing duties on imported foodstuffs might not be reduced or abolished altogether.

7. *Establishment of a Department of Nutrition.*—Since the reports referred to in paragraph 1 were published, a Department of Nutrition has been started and the work in hand at the present time includes the following:—

*Field work.*

(1) The examination of large numbers of school children to decide if there is a correlation between somatic measurements and the prevalent clinical signs of malnutrition.

(2) The study of the A.C.H. index of various classes to decide if it is adaptable to the children of Ceylon.

(3) Further dietary surveys are being carried out, the main purposes of which are to obtain quantitative data of the diets of village and urban workers.

*Nutritional Education.*

(1) Theoretical and practical classes on nutrition are being given to elementary school teachers.

(2) An elementary book on dietetics has been prepared for publication. The values of foodstuffs are represented by coloured graphs which contrast one foodstuff with another. The book is written for school teachers, social workers and other members of the lay public.

*Research.*

(1) The examination of still-born children is being continued. The amount of vitamin A in the livers, and certain calcium determinations are being carried out.

(2) Experiments are being done on the calcium metabolism of poor class children who have a low calcium intake, with special reference to the calcium balance.

(3) Some bacteriological and chemical work has been done on curds. Two organisms predominate in the curds used in certain parts of Ceylon, a yeast and a streptococcus. The amount of acidity produced is sufficient to destroy such organisms as those of dysentery. There is little doubt that the use of curds is far safer than milk under the primitive sanitary conditions existing in villages. Also the presence of yeast brings additional vitamins to the diet. A paper is being prepared on this subject.

## MAURITIUS.

Area: 720 sq. miles.

Population (1936).

Indian ... 268,546

General ... 142,374

Total ... 410,920

Birth Rate: 34.9 per 1,000  
(1936).

Infant Mortality: 142.3 per  
1,000 births (1936).

Death Rate: 26.4 per 1,000  
(1936).

1. *General.*—The papers concerning Mauritius consist of a despatch from the Governor covering a memorandum by the Director of the Medical and Health Department. In order to co-ordinate such efforts as can be made to investigate the problem or to educate the public in the elements of the nutrition question, the Governor proposes to set up a representative local Committee.

2. *Composition and Nutritive Value of Dietary.*—The staple foods are rice and pulses which together with oil used in cooking provide most of the energy. Animal protein, consumed as fresh fish, meat or goat flesh, is eaten about once a week. Bread is consumed by the Creole but not as a rule by the Indian, who, however, occasionally uses wheat flour for his chupatties.



The consumption of fruit in due season is liberal. Attempts have been made by the Medical Department to collect records of typical domestic budgets, but in view of the unreliability of the returns no definite conclusions can be based upon them. It does appear, however, that judged by European standards the diet often contains too little protein and too much carbohydrate, a feature common in the diets of Asiatic communities living in the tropics.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The entire lack of records of past investigation and the difficulty of obtaining reliable information on present day conditions is emphasised. Nevertheless, the memorandum inclines to the general view that the earnings of the labouring classes are sufficient under present conditions to provide them with an adequate diet. Support is given to this conclusion by the healthy and well nourished state of the children attending the elementary schools of the Colony, and there is a noteworthy absence in this Report of any mention of gross deficiency disease. That degrees of undernourishment must exist, however, is evidenced by the improvement seen in the weight and general health of prisoners when placed on a regular and adequate dietary. Further, although based on casual impressions, there may be substance in the view held by some, that the field labourers of to-day are decidedly less robust than those of a generation or more ago and that the tasks performed are smaller.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The economic life of the Island is dominated by the sugar industry. The bulk of basic foodstuffs is imported and at present the prices of these are nicely adjusted against the price of sugar. If this balance is not disturbed the outlook is fair; but if the price of imported foods should rise without there being a compensatory rise in the price of sugar nothing that can be done locally will prevent great privation for a considerable period. Experiments made locally give little promise of rice ever being grown within the Island in sufficient quantity, and efforts to encourage the production of supplementary foods such as maize, peas, beans and potatoes have met with very limited success. Only pressure of economic necessity forces the population to substitute these foods to any extent for the staple rice. However, a further and more extensive attempt is shortly to be made to supplement the existing production of home-grown foodstuffs.

5. *Researches and Surveys.*—It is agreed that nutritional research is desirable but that it could not be undertaken without the services of a special staff. If the Colonial Development Fund were prepared to assist by the provision of a special

officer to study the question, a more comprehensive investigation of the whole problem might be undertaken, but no guarantee could be given at this stage that funds would subsequently be forthcoming from the local Treasury to implement any programme which might be drawn up as a result of such a study.

6. *Practical Measures for Improvement of Nutrition.*—Financial considerations preclude any extensive development but attempts have been made to counteract the drift away from field labour towards artisan and black coated employments by the establishment of allotment settlements, the holders of which are encouraged to become self-supporting in respect of food requirements. Efforts are also being made to stimulate the local production of slaughter cattle in substitution of the somewhat poor quality animal now imported from Madagascar. With assistance from the University of Pretoria a study is being made of grasses and pasturage. On the medical side, useful agencies such as child welfare societies are in existence in a few areas and free milk is sometimes supplied in necessitous cases. Attempts are also being made to stimulate the fishing industry.

### SEYCHELLES.

*Area:* 156 sq. miles.

*Population:* 29,803 (1935).

*Birth Rate:* 27.48 per 1,000 (1935).

*Infant Mortality:* 91.57 per 1,000 births (1935).

*Death Rate:* 14.09 per 1,000 (1935).

1. *General.*—The papers submitted include minutes by the Senior Medical Officer and the Director of Agriculture and a memorandum by Mr. W. F. Stephens, unofficial member of the Executive Council. The establishment of a Standing Committee on Nutrition is considered desirable but until a preliminary scientific estimate of the Colony's needs and its means to supply these needs has been made, such a Committee would, in the Governor's opinion, have no basis for effective action.

2. *Composition and Nutritive Value of Dietary.*—Although polished rice is generally accepted to be the staple food of the natives in the main island (Mahé), and the unpolished variety in the outlying islands, the quantity imported is, by calculation, manifestly insufficient to provide all the carbohydrate being consumed by the population. By inference it is assumed that manioc, sweet potato, breadfruit and banana must together form a much more important element in the average diet than is generally admitted. Fish is said to be largely consumed but in Mr. Stephens' opinion this is an exaggeration owing to the frequent uncertainty of supplies. The consumption of milk is very low and that of green vegetables almost negligible mainly



because the natives have no natural liking for these articles of diet, and partly also because praedial larceny is so habitual and widespread as to discourage potential producers. Bacca, the native toddy, which is a wholesome beverage made from the juice of the sugar cane, has of late years been largely superseded by a noxious and illicit drink called La Purée, which is derived from the fermentation of all kinds of vegetable refuse. Certain restrictions upon the cultivation of sugar cane and the home manufacture of Bacca have recently been abolished with the object of combating the Purée evil and restoring the use of an invaluable food.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The state of nutrition of the majority of the people is poor. There is much chronic ill-health, low resistance to disease and incapacitating sickness, which is a constant source of economic loss to employers of labour. Neuritis and the disease locally known as “decoque” are regarded as evidence of vitamin deficiency. Beriberi is still seen occasionally even in the outlying islands where unpolished rice is used. Pulmonary tuberculosis is very prevalent and chronic ulcers are exceedingly common.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The islands are dependent for their income on the sale of coconut products and various essential oils.

5. *Researches and Surveys.*—A dietary survey to include the analysis of local foods is considered highly desirable; but such could not be undertaken without employing a specialist officer.

6. *Practical Measures for Improvement of Nutrition.*—The stamping out of the abuses surrounding the manufacture of Purée and the evils of praedial larceny are the two most urgent measures for improvement occupying the close attention of Government. The Director of Agriculture recommends further measures for the introduction of better milk and meat-producing animals, poultry, etc.; the continued extension of good quality pasturage crops; improvements in the cultivation of local food crops and fruits, including citrus, mangoes, and avocado pears. On the medical side measures will include the expansion of maternity and child welfare services, health visiting, and the provision of a cheaper milk supply.

## WEST INDIES AND NEIGHBOURING TERRITORIES.

### BAHAMAS.

*Area*: 4,403 sq. miles.  
*Population*: 66,219 (1936).

*Birth Rate*: 32·9 per 1,000  
 (1936).

*Infant Mortality\**: 66·3 per  
 1,000 births (1936).

*Death Rate*: 18·8 per 1,000  
 (1936).

\* Refers to New Providence.

1. *General*.—A Standing Committee has been appointed to advise on all matters pertaining to public welfare. In forwarding a survey of the situation, prepared by the Medical Officer, the Governor emphasises the close co-operation and co-ordination of the Medical, Agricultural and Education services secured by the Government.

2. *Composition and Nutritive value of Dietary*.—The diet of 75 per cent. of the labouring classes, who compose the bulk of the population, consists of boiled fish and hominy (finely cracked maize with husk removed) for breakfast; corned beef, salt beef, fish, hominy or peas and rice (polished), Irish potatoes, sweet potatoes, plantains and bread without butter, for dinner; and bread and tea without milk for supper. Mutton or pork is bought once a week as a rule. Lettuce, spinach, cress, beets and carrots are never served and tomatoes only occasionally. The remainder of the labouring classes have a slightly more varied diet with somewhat more vegetable food. Citrus and other fruits (excepting bananas, perhaps) are not readily available and too expensive for the labouring classes. Milk is also too expensive for consumption on a large scale. Making generous allowances, the calorie value of the diet does not exceed 2,000 per head per day.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Pellagra is very prevalent and accounts for a great deal of illness and debility. Dental caries is also extremely prevalent; general debility and lethargy are prevalent; skin eruptions and catarrhal infections, fairly common; and beriberi, scurvy and rickets of occasional occurrence.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—There is little in the report calling for comment under this heading. When next the existing tariffs come under review it will be borne in mind that these should be adjusted in such a manner as to encourage the consumption of foodstuffs



of high nutritive value. Steps which it is proposed to consider are either an increased duty on such foods as white flour and polished rice, or a reduced duty on whole-wheat flour and unpolished rice. The Agricultural and Education Departments working together have endeavoured to arrange for the employment of an increasing number of agricultural school teachers, the establishment of school gardens and to encourage generally the development of agriculture. Increased farm production would render the Colony less dependent on imported fruit, vegetables, dairy produce and eggs. One of the main exports is tomatoes which are shipped mostly to Canada. This has greatly encouraged vegetable farming and is expected to result in an increased use of tomatoes in the local diet.

5. *Researches and Surveys*.—On the agricultural side there is need to investigate the possibilities of growing suitable fodders for cattle. It is not practicable to grow timothy, for example, and almost all hay is imported. This results in fresh cow's milk being too expensive for the poorer classes.

6. *Practical Measures for Improvement of Nutrition*.—On the medical side several new measures have recently been adopted, namely, the periodic examination of school children, lectures and demonstrations in hygiene, and the inauguration of pre-natal and post-natal clinics. As a result of instruction on diets and nutrition, two settlements decided to eat more vegetables, such as cabbage, etc., and to adopt the use of fresh goats' milk. The inhabitants of these two places admit that the state of their health and that of their children has greatly improved. On the agricultural side people are being encouraged to engage in back-yard vegetable farming and in general to increase the cultivation of citrus fruits and other nutritive produce.

## BARBADOS.

*Area*: 166 sq. miles.

*Population*: 188,294 (1936).

*Birth Rate*: 31.80 per 1,000 (1936).

*Infant Mortality*: 198 per 1,000 births (1936).

*Death Rate*: 18.54 per 1,000 (1936).

1. *General*.—The local Committee appointed to consider and report on the question of nutrition in Barbados has submitted a printed report in which the nutrition of infants, the nutrition of school children and the nutrition of the working classes are separately considered.

2. *Composition and Nutritive Value of Dietary*.—The average diet of the working classes consists chiefly of rice, flour and

other cereals, sweet potatoes, yams, onions, salt pork or beef, salt fish, sugar and tea. Milk consumption is exceedingly low, and in the majority of cases condensed milk is used instead of fresh. The great shortage of milk, eggs and fresh vegetables cannot be too strongly stressed and there is no reason to doubt that many households live on the borderline of extreme poverty. Infants are weaned at the age of one to three months and thereafter are fed on sugar-tea and cornmeal pap with the addition of potatoes, rice and biscuits as they get older. It is known that the weekly wage of parents (paid on Saturdays) is insufficient to feed the whole family for a week and that many children have no regular meals after Wednesday in each week and come to school hungry on Thursdays and Fridays.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The poor physique of the average labourer, the very high incidence of dental caries, the prevalence of pellagra, the increasing prevalence of tuberculosis, and the general low resistance to infectious disease, provide sufficient evidence that the diets are seriously deficient.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The present condition of the sugar industry which precludes the possibility of paying higher wages, and the fact that large families are the rule rather than the exception, provide the main limitations to satisfactory nutritional conditions. Wages have increased since the war, but more is spent on clothing and transport; the result has been an increase in the basal cost of living to such an extent that probably less is being spent on food than before the war.

5. *Researches and Surveys.*—The Committee's investigation into the position leads them to recommend that the Medical Department should carry the enquiry further.

6. *Practical Measures for Improvement of Nutrition.*—Government has accepted the recommendation of the local Nutrition Committee for the establishment of a system of daily distribution of milk and biscuits to elementary school children at an annual cost of about £5,000. The proposal that Baby Welfare Clinics and Creches should be established in parishes not already provided with these has also been approved.

Steps are also being taken to encourage the more extensive cultivation of vegetables by peasant proprietors and by those who rent small plots of land for their own use. Consideration is also being given to the possibility of encouraging the greater use of wholemeal flour and other essential articles of food, by the removal or reduction of the duty imposed on them under the customs tariff.



## BERMUDA.

Area: 19 sq. miles.

Population: 30,951 (1937)  
12,143 white, 18,808  
coloured.

Birth Rate: 23.1 per 1,000  
(1937) 17.3 white, 26.8  
coloured.

Infant mortality: 71 per 1,000  
births (1937) 49 white,  
81 coloured.

Death Rate: 10.6 per 1,000  
(1937) 9.6 white, 11.3  
coloured.

1. *General*.—The appointment of a Committee is not mentioned in the report submitted by the Governor.

2. *Composition and Nutritive Value of Dietary*.—Practically every family eats some meat or fish once a day—though much of it is from tins. Salt codfish is extensively used, but less than it used to be. Bread, potatoes and rice are important items of diet. Fresh vegetables are eaten in fair quantities, but fresh fruit only a little by the poorer people, while milk, butter and eggs are expensive. There are 1,750 milk cows on the island, and condensed or dried milk was imported to the value of £22,000 in 1937.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—The school children have been examined. Figures are given for the findings in 500 white and 500 coloured.

|  | White. | Average No.<br>of children<br>in family. | Coloured. | Average No.<br>of children<br>in family. | Total. |
|--|--------|--|-----------|--|--------|
| Small but healthy                      | 7      |  | 7         |  | 14     |
| Bones suggestive of<br>old rickets ... | 19     |  | 14        |  | 33     |
| Poorly nourished ...                   | 25     | 4.6                                      | 27        | 7  | 52     |
| Over nourished ...                     | 15     |  | 8         |  | 23     |

About two-thirds of the children have dental caries and many have enlarged tonsils. Slightly enlarged thyroids are found occasionally, serious enlargements almost never.

4. *Economics of Diet*.—The labourer's wage has been 10s. a day. So unless a family be careless, as is sometimes the case with the poorer whites, or if the family be not too large, as it frequently is among the coloured, the living conditions are comfortable. The deaths from tuberculosis illustrate this, and have steadily declined since the Great War to 12 in 1937—(a rate of 37 per 100,000 living).

5. *Researches and Surveys*.—Only a beginning has been made on the study of diets, but the evidence is that all classes eat much the same variety, the poorer people having fewer sweets and

eggs and less fresh milk and fresh fruit. Poverty is the usual deterrent to a good diet, and poverty is usually due to too large a family.

6. *Practical Measures for the Improvement of Nutrition.*—A beginning has been made towards the practice of birth control under the direction of the Health Department. A domestic science school has been started to teach school girls the fundamentals of dietetics and to provide training for hotel and domestic help. The Welfare Society with its district nurses gives prenatal instruction and runs baby clinics. The Department of Health is providing dental care to the poorer children and endeavouring to clear other foci of infection.

### BRITISH GUIANA.

*Area:* 89,480 sq. miles.

*Birth Rate:* 35·3 per 1,000  
(1936).

*Population* (1935).

|                 |         |
|-----------------|---------|
| East Indians... | 138,334 |
| Africans ...    | 128,559 |
| Europeans ...   | 10,689  |
| Others ...      | 50,637  |

*Infant Mortality:* 120 per  
1,000 births (1936).

*Death Rate:* 20·4 per 1,000  
(1936).

|           |         |
|-----------|---------|
| Total ... | 328,219 |
|-----------|---------|

1. *General.*—The comprehensive report which is submitted was prepared by a specially appointed Committee, since formed into a Standing Nutrition Committee.

In considering the position in British Guiana it is of some importance to remember that the various races—Indians, Africans, Portuguese, Chinese—which make up the total population have very different dietary habits, and further, that even the dietary of immigrant Indians born in India differs largely from that of the creole Indian descendants of immigrants, born in the Colony.

2. *Composition and Nutritive Value of Dietary.*—*Cereals.*—Rice is grown over wide areas and is the staple food of more than a quarter of the population; maize is also grown to some extent. *Vegetables and fruits.*—Sweet potatoes, tannias, yams, cassava, bananas, plantains and bread fruit are commonly used by the labouring and other classes as also are imported pulses and groundnuts. *Animal foods.*—Although protein deficiency is common it cannot be said that there is a shortage of fresh meat; many varieties of local fish are marketed and eggs and milk are fairly plentiful; with the exception of limited supplies in rural areas, all butter is imported. The main difficulty about milk is its



unsatisfactory quality due to adulteration and contamination. The *per caput* consumption is unknown but is probably very low even though supplies of a kind are quite readily available. Fats are generally obtainable from such local products as coconuts and avocado pears.

In regard to the nutritive value of dietaries, the average diet of the immigrant Indian shows a general shortage of protein, fat and vitamin A and a relative excess of carbohydrate. They drink almost no milk. With the passing of time, the creole Indian will wholly replace the immigrant Indian and the stricter and narrower dietetic customs of the latter will give place to the broader and more balanced diet of the former. Africans as a rule enjoy an unrestricted dietary except perhaps on the mines where fresh fruit and vegetables are generally conspicuous by their absence. No special comment is called for with respect to other races. A point worth noting is that if mineral deficiency in the soil is paralleled by a similar deficiency in its produce, then calcium and to a less extent phosphorus will be deficient in British Guiana vegetable foodstuffs.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The generally low protein, fat and vitamin A content in the dietary of the East Indian is reflected in the high incidence of pyorrhoea, gingivitis, xerophthalmia, asthmatic conditions and infectious diseases found among them. The African is more robust than the Indian and it is chiefly in remote districts and on the mines, where rations may be limited, that xerophthalmia and keratitis occur with any frequency. Among the Portuguese tuberculosis is fairly common and suggests a lowered resistance consequent on vitamin A deficiency.

Nephritis is responsible for a large number of deaths annually; but it is not improbable that the many cases thus diagnosed are in reality beriberi or endemic dropsy. The high incidence of megalocytic anaemia, most frequent in East Indian women, is another problem of grave social and economic importance. Prevalent customs in regard to infant feeding are notoriously bad, and medical officers are unanimous as to the general malnutrition among infants and young children seen in institutions, villages and rural areas. The occupational efficiency of the estate labourer is low; his resistance to disease is poor and he quickly succumbs to attacks of bronchitis, pneumonia and enteritis—conditions which are complicated by malaria and hookworm infection, the most widespread diseases in the Colony.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Quantitatively, there probably exists no shortage of any essential foodstuffs produced and available in the Colony. The source of nutritional disease is to be found in poverty,

racial prejudice, restricted availability of certain foods in hinterland or isolated areas, general dietetic ignorance, or a combination of two or more of these. Agricultural wages have increased by 90 per cent. since pre-war days while the cost of living has increased by only 4·2 per cent. during the same period. Although these figures represent a very considerable improvement in conditions the fact that more money is being spent on non-essentials makes it by no means certain that the nutritional status of agricultural workers has improved to the extent suggested by the index numbers. It may be said that no systematic attempt has so far been made to organise the agricultural production of the Colony from the standpoint of the nutritional needs of the people. This is particularly true in regard to milk, there being no dairy farms in existence capable of providing towns and institutions with a guaranteed supply of reasonably high quality milk.

5. *Researches and Surveys.*—Although a certain amount of work relating to human nutrition has been done it is not yet possible clearly to define the precise extent of undernourishment and malnutrition in the community. It is recommended that further work should be organised to include three stages of investigation as follows: (1) preliminary dietetic and disease surveys, adequately designed in the light of modern methods, to determine the present nutritional status of the inhabitants; (2) experimentation to test the efficacy of any suggested measures for improvement, *e.g.* testing improved ration scales for labourers in mining areas, and recording height, weight and mental aptitude in milk-fed and non-milk-fed groups of school children; and (3) practical application on a wide scale of those measures of improvement which by experimentation have proved feasible. The work envisaged does not, in the opinion of the local Committee necessitate the appointment of highly paid experts but may well be undertaken by existing Government staff provided that allocations for subordinate staff and some additional equipment are made available.

An experiment in feeding milk to school-children is now being undertaken.

6. *Practical Measures for Improvement of Nutrition.*—Having acquired more exact information as a result of the investigations referred to in the preceding paragraph, the Government will first of all direct its attention to improving the nutrition of expectant mothers, infants, and pre-school and school children. Thereafter, Indian immigrants, shop assistants, and workers in mining areas will receive consideration. Revision of dietary scales for hospitals and public institutions, lectures and demonstrations in clinics and schools, and co-operation with the Agricultural and Veterinary Departments with a view to improving milk and meat supplies, will form part of the programme to be undertaken.



## BRITISH HONDURAS.

*Area*: 8,598 sq. miles.  
*Population*: 56,071 (1936).

*Birth Rate*: 33.5 per 1,000  
 (1936).

*Infant Mortality*: 152.7 per  
 1,000 births (1936).

*Death Rate*: 20.2 per 1,000  
 (1936).

1. *General*.—The Governor has appointed a Committee consisting of the Senior Medical Officer, the Agricultural Officer and the Superintendent of Education. In preparing the report, the Committee enlisted the services of the Customs Department, the Forest Department, the Registrar-General, District Commissioners and interested members of the community. The report, with its thirteen appendices, extends to nearly 200 pages of typescript and contains much detailed information on the geology, water supply, and agricultural produce of British Honduras. In addition very full accounts of the dietetic habits of the various communities living within the Colony are given and full indications of the schemes on hand for the improvement of nutrition and public health are provided.

2. *Composition and Nutritive Value of Dietary*.—A discussion of the dietetic habits of the population of British Honduras is complicated by the number of races, ethnologically diverse and differing in their food habits according to economic status and the place of abode, urban or rural.

The following divisions of the population must be considered separately:

(a) The indigenous *Mayan Indians* are agriculturists, living on a diet of which the basis, both of food and drink, is some preparation of maize. One method of preparing the cereal described in the report results in the *tortilla* a very thin pancake, which is served at every meal. Another method provides *tamales*, in which a stuffing of various vegetables, compounded with chicken meat is inserted into the "husk" of the maize. *Posol* is a drink made with maize steeped in a solution of lime water, washed, and then boiled into a thickish liquid.

No fresh milk is available, but tinned milk of the cheapest kind is imported and sold at enhanced prices in the villages. Although chickens and pigs abound in Indian villages, eggs and pork are seldom eaten, being transported to the coastal towns. Wild game and fish from the creeks supply protein, but in some districts the heart of the cohune palm, boiled and seasoned, is used as a substitute for meat. The

women and children of the Toledo district, probably because of a mineral deficiency unconsciously felt, use an edible calcareous earth.

Although an almost infinite variety of foodstuffs is available, the Indians subsist chiefly on the products of maize.

(b) The *Caribs* are a class of negro people whose staple diet is cassava and fish. Occasionally they eat rice and beans, seldom meat and never green food. Sweetened tinned milk is used to flavour tea.

(c) The *East Indians* who have been introduced into the Colony have to a great extent dropped the dietetic prejudices of their race. In addition to large quantities of rice, they eat beef and pork and in some districts have the reputation of being heavy meat eaters.

(d) The *Spaniards*, who for the most part are political refugees from the neighbouring republics, use rice and beans for their main foods and consider no meal complete without tortillas. Salt pork or salt beef is eaten twice in the week and green vegetables are added when in season. Fruit, though plentiful, is not utilised as a main article of diet.

(e) The *Creoles*, direct and indirect descendants of the slaves transported to fell mahogany, form the largest group in the Colony. If they can afford it, the urban Creoles eat large quantities of meat. Polished rice, dried beans, plantains and fish are the staple food of the others. Tinned milk takes the place of butter and while fresh salads are never prepared, cabbage and spinach are relished.

(f) The *Chicleros* and the workers in the mahogany camps form a special group because their food is provided by the mahogany contractors under a Labour Ordinance of 1934, confirming an established tradition. Salt pork and flour is the universal ration, but the labourers supplement this with a variety of supplies purchased from the commissary, with game hunted in the forests, and with green vegetables grown in gardens in some of the more progressive camps or procured from neighbouring villages.

(h) *Americans, Europeans and Syrians* are found in isolated groups throughout the Colony and are dependent on locally grown food and on imported tinned food.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The Medical Officers of the Colony are unanimous in saying that while malnutrition and deficiency diseases do exist, they are not so prevalent as might be expected. Deficiency of vitamin A leads to phrynoderma amongst school children, while hemeralopia and xerophthalmia are also noted



occasionally. Since 1899, 27 cases of beriberi have been reported, but there is a larger incidence of cases of oedema of the legs probably accounted for by B-avitaminosis. Twenty-one cases of definite pellagra have been recorded since 1920 but it is thought that a pellagroid type of dermatitis is widespread, while symptoms such as "burning feet" and "butterfly wing" are regarded by the doctors as due to lack of vitamin B<sub>2</sub> complex. Scurvy is not unknown especially among the youngest children, the Medical Officer at Corozal reporting that he noticed three cases of scurvy in a month. Only mild manifestations of rickets are encountered.

Dental disease is not markedly evident, but the children in the El Cayo district whose parents permit them to drink rain water show a markedly greater percentage of carious teeth compared with the river water drinkers in the same area.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc).*—Details of labour conditions existing in the Colony are confined to the employees in the forest industries. A sample budget of a labourer in one of the mahogany camps shows that of the five dollars which is the average wage, three dollars are spent in the camp and two dollars are contributed to the family's expenses. The report, while admitting that some camp managements are enlightened, enters with some detail into various abuses to which the "truck", "seminal" and "giro" contracts are subject and note that many cases of hardship are incurred through the families in the towns not receiving a proper and regular allowance. This matter is now receiving the attention of Government.

In the camps the labourer is encouraged to buy tinned foods because he has not the available cash to purchase other foodstuffs in the open market. The Committee note that during the Great War the people were dependent on imported supplies of food. They are concerned with the quality of tinned supplies. A leading contractor in a communication to the Committee emphasises that food, sufficient both in quantity and quality is available, but the labourer has not the initiative nor the knowledge to use it. He adds "It . . . is a pity both from the point of view of personal health and the country's economics, that the people are not educated to a freer use of fresh (untinned) meat and green vegetables". Elsewhere in the report mention is made of the task it will be to educate the people to use the anti-scorbutic fruits which are at hand.

5. *Researches and Surveys.*—The Committee are anxious to establish a properly constituted team of workers to make:

(1) A dietary survey of the various sections of the inhabitants.

(2) An analysis of foodstuffs consumed.

Once in possession of these highly essential data, they will be able to plan propaganda on a sound basis.

6. *Practical Measures for Improvement of Nutrition*.—These include the encouragement of local produce, improved marketing, development of transport, and propaganda by educational and nutritional services. There is a valuable infant welfare centre in Belize. There is general agreement that the days when the Colony can depend solely on the export of mahogany are passing and of possible sources of wealth, agriculture is both the most promising and the most universally beneficial.

## JAMAICA.

*Area*: 4,450 sq. miles.

*Population*: 1,138,558 (1936).

*Birth Rate*: 32.35 per 1,000 (1936).

*Infant Mortality*: 118 per 1,000 births (1937).

*Death Rate*: 17.4 per 1,000 (1936).

1. *General*.—A special Committee, consisting of representatives of the Medical and Agricultural Services, a private medical practitioner, and members of all classes of the community has been appointed. The major responsibility for devoting attention to development of nutritional knowledge rests with the Chairman of this Committee whose substantive position as Assistant Director of Medical Services brings him constantly in touch with matters bearing on nutrition. The Committee first submitted an interim report together with a special note by Dr. D. Whitbourne on the nutrition of children in the corporate area of Kingston and St. Andrew, and, later, a fuller report following the collection of additional data.

2. *Composition and Nutritive Value of Dietary*.—With so many grades of society, diets vary considerably in quantity and quality. The best nourished receive as protein small amounts of fresh beef and occasionally goat flesh, chicken and fish. Salt meat and salt fish are more largely consumed. Peas and beans are used to a large extent and are the chief source of protein for the poor. Milk, when used, is nearly always sweetened condensed, fresh cows' milk being rarely taken even when available. Cheese is seldom used.

Carbohydrates are represented mainly by polished rice (an aversion from unpolished rice exists), and by tubers such as yams, coco-yams, sweet potatoes, cassava and bread fruit. Bread and biscuits made from white flour are largely used in



towns, and constitute a large part of the diet of the poor. Fat, the chief source of which is coconut oil, is deficient in the majority of diets; butter is a luxury, native beef provides little fat, and, as already mentioned, milk is the cheap tinned variety. Vegetables such as pumpkins, onions and tomatoes are not extensively used and are not very popular among children who are in many cases allowed to choose their diet and so omit vegetables and fresh milk. The most commonly used is a coarse spinach; an uncooked green salad is never eaten. The unripe banana is used as a vegetable by all classes. Oysters, prawns and crabs are occasionally used as supplementary foods. Beverages include tea, cocoa and coffee, the last being the most popular among labouring classes who also favour "bush tea" infused from various local leaves and roots.

Special stress is laid on the shortage of protein. Local animal products are sparingly used, but the shortage in the habitual vegetable diet is partly made good by imports of salted and canned fish and meats, and of condensed milk.

To sum up, although there is no lack of variety nor shortage of food for those who can afford to buy it and know how to use it, the diet of the poorer classes is deficient in animal protein and fat, and contains much salted or otherwise preserved foods, polished rice and white flour.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The generally strong physique, good humour, contentment and patience of the Jamaican negro labourer are regarded by some as evidences that the nutritional conditions are not seriously at fault. It is authoritatively reported also, that the island products contain abundant vitamins and that there is little evidence that vitamin deficiency is a serious cause of disease or disability. Others, on the other hand, conclude that a very high percentage of the population are suffering from varying degrees of subnormal nutrition and that the nutritional state of a distressingly large proportion of the labouring classes is definitely bad. The reason for this divergence of opinion is that satisfactory statistical data in regard to adults are not available. The position with regard to children seems, however, to be much clearer. Of 12,000 children examined, multiple avitaminosis was found in about 20 per cent., the most striking signs being blindness, glossitis, stomatitis, dry skin and anaemia. Evidence of mild rickets is frequently found among younger school children and although no cases of beriberi, pellagra and scurvy have been detected in schools, the condition of many children suggests a near approach to these diseases. Dental caries is also exceedingly prevalent. The state of nutrition, alike in adults and children, is complicated by the considerable prevalence of yaws, hookworm infection and malaria.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Adverse economic conditions, the poverty of the masses, low wages, unemployment, the over-large family, and the high percentage of illegitimacy (71 per cent. of all births) are the root causes of most of the malnutrition found. The average income of 184,000 or 92 per cent. of the employed population in 1935 fell below 25s. per week, and 147,700 or 71 per cent. received an average of 14s. per week. These are the sums earned by the male wage earner responsible for an average of five persons, but in a large number of cases he shirks his responsibility leaving it to the women to bear most of the family burden on an intermittently earned wage of 5s. per week. The difficulty of maintaining families under such circumstances is reflected in the infant mortality.

Jamaica, being an agricultural country, depends economically on its export trade in agricultural products. A natural consequence of this has been an agricultural policy directed primarily to fostering production of export crops such as the banana, and until recently there has been no conscious attempt to develop such local food supplies as are necessary for a proper dietary. Tomatoes, lettuce, carrots, turnips, etc., are not produced on a large scale, and are mostly sold by the small cultivator, who has little taste for them, to the upper and middle classes. The question of reduction of import duty on skimmed milk has been considered; but it is thought preferable to approach the problem of increasing milk consumption by concentrating on the development of the local dairy industry.

5. *Researches and Surveys.*—An examination of 12,000 school children has been made (see above). It has been suggested that inquiry is desirable into the food value of sugar cane, raw sugar and molasses on the grounds that their dietetic value may be greater than that of refined sugar.

6. *Practical Measures for Improvement of Nutrition.*—Measures by which it is proposed to improve present conditions include the development of animal husbandry with a view to providing an adequate supply of meat. It is also hoped, as part of the scheme for developing animal husbandry, to replace imported condensed milk by a product manufactured locally. Though in itself, however, this will not cause any improvement in nutrition, it should greatly assist in making husbandry remunerative. Improvement of fisheries and intensification of poultry farming are other matters which will receive attention. The possibility of cultivating vegetable products rich in protein will be investigated.



A scheme of instruction in schools likely to produce valuable results has already been put in operation. This concerns the establishment of lunch kitchens in a number of elementary schools where the older girls are employed in preparing lunches as part of their domestic science course. Boys are also brought into the scheme through encouraging their interest in agricultural pursuits, the produce from their school gardens being partly used for the lunches and partly marketed under the auspices of the Jamaica Agricultural Society. It is intended to make periodical comparisons of the physical condition of children in schools having well-established lunch kitchens with that of children in schools where there are no such amenities. The Jamaica Welfare League are co-operating in the work.

Provision of a daily supply of milk to the school children of Kingston is engaging the attention of the Government; and a public health nursing service, now in process of development by the Medical Department, promises to be a useful factor in the improvement of child welfare and maternity services.

## LEEWARD ISLANDS.

### ANTIGUA.

*Area:* 108 sq. miles.  
*Population:* 34,230 (1936).

*Birth Rate:* 37.1 per 1,000  
(1936).

*Infant Mortality:* 111.2 per  
1,000 births (1936).

*Death Rate:* 20.4 per 1,000  
(1936).

1. *General.*—Short memoranda have been submitted by the Senior Medical Officer and the late Inspector of Schools. It is proposed to appoint a special Committee to make further investigations and practical suggestions for dealing with the problem.

2. *Composition and Nutritive Value of Dietary.*—The principal meal of the day is usually composed of fish (salted or pickled) boiled with rice or cornmeal; some vegetable foods such as egg plant, ochroes, squashes, unripe bananas, and mangoes; and starchy foods such as sweet potatoes, yams, tannias, cassava, eddoes and dasheens. In the case of children cornmeal “pap” with sugar is almost the sole article of diet. On questioning nearly 2,000 children it was found that 35 per cent. drink practically no milk and the rest an average of less than half a pint per day, most of it being taken on Sundays; 71 per cent. eat few or no eggs; 67 per cent. eat little or no

meat and 11 per cent. little or no fish. Green vegetables were, however, included in 71 per cent. of these dietaries. The widespread custom of chewing sugar-cane is important. Town conditions are slightly better than those in rural districts.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Nutrition on the whole is fairly good among people of working age; the chief sufferers are children and old people. General oedema is not uncommon among infants and there are evidences of vitamin A and B-complex deficiencies. Statistics covering the years 1927-36 show a tendency towards a falling infant mortality rate.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The nutrition problem on this island is very largely an economic one. Parents cannot afford to buy proper food; and working mothers are often obliged to leave their children with neighbours who neglect to feed them.

5. *Researches and Surveys.*—The Governor suggests that a general survey of the whole Leeward Islands group would be more advisable than any endeavour to arrange a local survey in Antigua only.

6. *Practical Measures for Improvement of Nutrition.*—A five-year scheme for the development of peasant agriculture, which has recently been drawn up, includes proposals for the improvement of livestock with the double aim of increasing the market value of the stock and improving the nutritional value of livestock products. The conditions under which milk is produced and retailed in the island require careful investigation. At present there is great danger from tubercle infection, and possibly more use might be made of goats' milk which is practically free from this danger.

## LEEWARD ISLANDS.

### DOMINICA.

*Area:* 305 sq. miles.  
*Population:* 48,280 (1936).

*Birth Rate:* 31.58 per 1,000  
(1936).

*Infant Mortality:* 99.60 per  
1,000 births (1936).

*Death Rate:* 13.71 per 1,000  
(1936).

1. *General.*—A comprehensive report has been submitted by the Governor.

2. *Composition and Nutritive value of Dietary.*—The diet of the artisan and better class labourer normally consist of meat once a week, fish (fresh or salted) on other days, bread or



cassava meal, bananas (usually green and cooked), bread-fruit, avocado pears, coconuts, unrefined sugar or molasses, an occasional egg, cocoa or coffee, a few ounces of milk, and a very small quantity of fat for cooking purposes. The amount of milk available is insufficient for the needs of the population, and milk and butter as well as meat are too expensive for the poorer labouring classes who therefore rely mostly on locally grown root vegetables such as sweet potatoes, yams and tannias, together with bananas and pigeon peas. Quantities of flour, rice, maize and other cereals are imported. Most of the sugar used is imported, as also is dried and salted fish.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The Report emphasises the improvements in general health which have taken place in recent years. Both the general death rate and infant mortality rate are falling and, as a result of an active campaign against yaws and syphilis, there have been appreciable increases in attendances at elementary schools. It is remarkable that this improvement in general health has coincided with a period of severe economic depression.

The average adult labourer shows no sign of malnutrition unless in association with parasitic infection, venereal disease, malaria, or tuberculosis which is very prevalent. Anaemia is commonly associated with ankylostomiasis, but severe anaemias of pregnancy are rarely seen. School children compare well with European and American children of the same age as regards height, but the average weight for height and age is generally less. It is among infants and pre-school children that malnutrition is very commonly seen and assumes its greatest importance. The common practice of feeding infants on starchy foods, often from the first week of life, and the fact that mothers have to leave home to work, very often at considerable distances, and hence are unable to breast-feed their infants, are two factors largely responsible for the extent of infant malnutrition. The fact that malnourished children respond well to treatment with iron and a diet consisting of milk, marmite, cod liver oil and fruit juices, reveals the nature of the deficiencies which exist among them.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Citrus cultivation is the mainstay of the island. Unfortunately, the recent world economic depression coupled with devastation by hurricanes and damage to lime trees by fungus disease, has meant the abandonment of many estates, and general unemployment. Fortunately the soil is fertile and land for the growing of vegetable foodstuffs is available on easy terms.

5. *Researches and Surveys*.—Researches on the physical standards of children and the precise nature of malnutrition among infants are suggested as desirable. [See also under Antigua, paragraph 5.]

6. *Practical Measures for Improvement of Nutrition*.—Desirable measures mentioned are:—greater attention to dietetics in elementary schools; more active encouragement of the growing of crops of high food value for local consumption; improvement of milk supplies and especially the keeping of goats for milk purposes; extension of ante-natal and infant welfare centres.

## LEEWARD ISLANDS.

### MONTSERRAT.

*Area*: 32 sq. miles.

*Population*: 13,630 (1936).

*Birth Rate*: 39·32 per 1,000 (1936).

*Infant Mortality*: 118·7 per 1,000 births (1936).

*Death Rate*: 14·88 per 1,000 (1936).

1. *General*.—The papers include a memorandum by the Commissioner covering a report by the Medical Officer of Health. The formation of a special Nutrition Committee is considered unnecessary as the existing Board of Health, which includes in its membership two Medical Officers and the head of the Agricultural Department, is competent to deal with the matter.

2. *Composition and Nutritive Value of Dietary*.—The ordinary articles of diet include rice, white flour and cornmeal, which are imported in steadily increasing quantities, locally grown root crops and green vegetables, salted cod fish and herrings which are consumed in considerable quantities by the poorer classes, meat usually taken three times a week, and such fruits as plantains, bananas, oranges and mangoes in season. Citrus fruits are grown locally, but the bulk of supplies come from Dominica. Milk is cheap and should be within the reach of all; this also applies to meat which is usually of good quality. Sugar is produced locally but the bulk of that consumed is imported. The diets of the middle and upper classes conform to accepted standards of adequacy but those of the poorer classes are as a rule too rich in carbohydrate and too low in protein. Labourers perform heavy tasks of work on diets consisting mainly of bread and sugar with a small savoury of salted fish.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Nutrition is not a pressing public health problem in this island with its equable climate, wealth of sunshine



and a population largely consisting of peasants who cultivate their own small holdings. The people are normally robust, industrious, energetic and apparently well fed. It is only among poorer class expectant mothers and very young children that malnutrition assumes any importance. Among nursing mothers anaemia is not uncommon; and the problem in early childhood is solely one of unsuitable infant feeding. The percentage of illegitimate births is high as also is infant mortality.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—There has been a tendency in recent years, in consequence of the large area planted in cotton, for the people to pay insufficient attention to the growing of food crops, and it is generally agreed that the importation of rice, white flour and cornmeal is far in excess of what it should be in a community capable of growing its own foodstuffs in large quantities. Although the bulk of the population is self-supporting, there is always a certain amount of unemployment; and much poverty and destitution is to be seen especially following hurricane disasters.

5. *Researches and Surveys.*—Facilities for research do not exist. [See under Antigua, paragraph 5.]

6. *Practical Measures for Improvement of Nutrition.*—Measures specially mentioned are:—the raising of stock in larger numbers for meat and milk and the possible establishment of a model dairy farm; encouragement in the cultivation of school gardens and the further production of locally grown foodstuffs; a possible revision of customs tariffs in an effort to bring the prices of certain imported foods within the reach of the poorer classes; and the appointment of a Committee to deal with the problems of infant feeding and welfare.

## LEEWARD ISLANDS.

### ST. KITTS-NEVIS.

*Area:* 152 sq. miles.

*Population:* 37,454 (1936).

*Birth Rate:* 36.0 per 1,000 (1936).

*Infant Mortality:* 162.9 per 1,000 births (1936).

*Death Rate:* 26.0 per 1,000 (1936).

1. *General.*—No Committee has been formed. The Governor has forwarded a brief memorandum, prepared by the Senior Medical Officer.

2. *Composition and Nutritive Value of Dietary.*—The chief foods used are bread, sweet potatoes, rice, tannia, yams, maize, bread fruit and sugar, especially the fresh cane which forms a

considerable proportion of the dietary during the months of February to July. Imported cheese is largely used. Fish is plentiful; and fruits, such as mangoes, coconuts and wild raspberries are extensively used in season. Beef and mutton are always available, but high cost prohibits their use by the poor. Milk is also available, but here again price restricts its use.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Malnutrition is not present in any marked degree. It is most frequently seen among children and is mainly due to the insufficient wages earned by parents.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—No details given.

5. *Researches and Surveys.*—No facilities available. [See under Antigua, paragraph 5.]

6. *Practical Measures for Improvement of Nutrition.*—It is stated that a scheme to supply free milk and bread to school children would be of value but no specific recommendation is made.

## LEEWARD ISLANDS.

### VIRGIN ISLANDS.

*Area:* 58 sq. miles.

*Population:* 6,165 (1936).

*Birth Rate:* 38.2 per 1,000 (1936).

*Infant Mortality:* 140.6 per 1,000 births (1936).

*Death Rate:* 18.1 per 1,000 (1936).

In the brief memorandum submitted by the Commissioner it is stated that the staple food is an abundance of West Indian vegetables and fresh fish, and an unlimited supply of fresh, tubercle-free cow's milk. Nutritional diseases are practically non-existent and the physique of the people in general and children in particular is excellent. Their limbs are straight and sturdy, and the skins healthy and with scarcely a blemish.

## TRINIDAD.

*Area:* 1,978 sq. miles.

*Population:* 448,253 (1936).

*Birth Rate:* 32.93 per 1,000 (1936).

*Infant Mortality:* 96.82 per 1,000 births (1936).

*Death Rate:* 16.28 per 1,000 (1936).

1. *General.*—The representative Standing Committee which has been established has submitted a report and has also issued various pamphlets. The Committee regard the problem as



essentially one of making the Colony more food conscious and of finding ways and means to bring about an immediate increased consumption of the most nutritive foods. In addition to the publication of explanatory and advisory pamphlets on food and health, a propaganda "nutrition drive" was recently organised and carried through by the Agricultural, Health and Education Departments.

2. *Composition and Nutritive Value of Dietary*.—The diet of the *East Indian* labourer is almost exclusively composed of polished rice, white flour and dried peas, with small amounts of green and root vegetables and coconut oil as accessories. With the possible exception of salt fish, foods of animal origin (meat, eggs, milk and butter) are either absent from the diet or are consumed in such quantities as to have no practical value. In cocoa growing areas, fruit (mango and banana) is plentiful but is eaten mostly by children and not adults; in cane growing areas fruit is scarce and seldom eaten. The most serious factor is the under consumption of milk. A family of six or seven will have no more than one tin of condensed milk per week. The diet is grossly deficient in first class protein, animal fat, and vitamins. The diet of the *West Indian* is also ill-balanced and qualitatively deficient but is relatively superior to that of the *East Indian* especially as regards the amount of milk supplied to infants and young children.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Xerophthalmia is widespread throughout the Colony amongst *East Indians* of the labouring class and is prevalent not only on sugar estates but in towns and villages, in barracks and in the small holdings of peasant proprietors. It reflects the gross inadequacy of the *East Indian* diet especially in respect of vitamin A. The malnutrition from which the agricultural labourer suffers inhibits the urge to work, and as a general rule he is physically incapable of performing efficient work even for the habitual working week of 20 hours. The general physique of the *East Indian* is definitely inferior to that of the *West Indian* and he is much less resistant to chronic infectious disease such as hookworm and malaria. Especially noteworthy is the prevalence of a peculiar chest condition (aphan) confined to *East Indians* which consists in a marked degree of fixation of the chest wall accompanied by breathlessness and asthmatic cough. The aetiology of the condition is obscure but may possibly, it is suggested, be related to vitamin B deficiency. Clark, who has done considerable work in the Colonies (see also under Nigeria) on the toxic principles occurring in native foods, has examined the relationship between diet and nephritis in Trinidad. Nephritis of all types is unusually prevalent in Trinidad where tannia and other aroid tubers find a large place in the dietary.



4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—The more or less self-contained farm has as yet no real place in Trinidad agriculture. Here the emphasis has, in the past, been on export crops (cocoa, sugar, etc.), food crops being considered of secondary importance. In the past, a highly priced article, for example cocoa, was produced and sold in exchange for low priced imported foodstuffs. To-day, the position is somewhat changed; exportable articles tend to be relatively lower priced and the imported relatively higher priced. The development of the oil industry, which brings wealth into the Colony, tends, however, to offset this factor.

Over £1,000,000 is spent annually on imported foodstuffs, chiefly flour and meal, rice, condensed milk, meat, beans, peas, dholl, potatoes, onions and fresh vegetables. To meet world competition, the cost of production of economic crops must be kept as low as possible. This is not easy in Trinidad where labour achievement is low in relation to its cost. Consequently in times of depression caused by severe economic competition work must of necessity be curtailed, cultivation restricted and labourers thrown out of work. In the Colony to-day are numerous instances of estates where, say, a 20 per cent. greater efficiency on the part of labourers might prove the determining factor in the maintenance of the estates. It is in this connection that nutrition assumes real practical importance. If, owing to improved health, the labourer can, without more cost to the owner and without more strain to himself give, say, 20 per cent. more work, then estates, that in the aggregate form a valuable asset, will be retained to the benefit of the Colony in general and the labourer in particular. There is ample margin for expansion in the growth of food crops for consumption by labourers and their dependents; and time after time it has emerged that those labourers who had food gardens of their own were in a far better position than those who did not have this accessory means of balancing their family budgets.

5. *Researches and Surveys.*—Portions of this report are based on investigations by Drs. Lassalle, Seagar and Clark carried out between 1916 and 1931. Nothing further in the way of dietary surveys has been done. Several of the replies from the other West Indian Colonies suggest that comprehensive analyses to determine the nutritive value of West Indian foodstuffs are desirable. The Government of Trinidad do not consider that large expenditure on this subject would be justified. Data regarding the nutritive value of most of the foods which are to be found in the West Indies are available from the Philippines and Hawaii, and apart from minor differences due to soil and climate, country of origin will have but little effect on the composition of any particular foodstuff. The more important problem is considered to be essentially a practical one,



namely to find ways and means to bring about an increased consumption of protective foods as a whole (the broad general value of which is well known), rather than to determine whether one particular kind of fruit or vegetable is of higher nutritive value than another.

6. *Practical Measures for Improvement in Nutrition.*—It is possible here to make only brief reference to one or two of the more important directions in which efforts are being made. Public health and educational measures include the inauguration of cookery and domestic science training in girls' schools and women's training centres; courses in mothercraft; health weeks; hygiene teaching in schools and colleges; school medical inspection; and the improvement of dietaries in prisons, hospitals and other public institutions. The feeding of children will be given special attention in future and it is suggested that Government support should be given to the voluntary organisation conducting the School Children's Meal Centre at which 197,213 meals were given in 1938, 56,434 of which were free. Pre-school children, i.e., between the ages of two and five at present fall between two stools, for they have passed beyond the sphere of the Child Welfare League and are not yet eligible for care by the School Children's Meal Centre. Provision was made in the Estimates for 1938 for \$10,000 for the supply of milk to school children and for \$1,000 as a grant to the School Children's Meal Centre. The former figure has been increased to \$20,000 for 1939.

On the agricultural side no efforts will be spared to devise further means to improve the milk situation and especially to encourage the keeping of goats for milk purposes. Of scarcely less importance is the need to stimulate an increased production and consumption of green vegetables. To arouse interest in this, school garden competitions have already been started. The Nutrition Committee is also considering the problem of white flour and is making enquiries in Great Britain and elsewhere in the hope that wholesale importers may be able to supply a grade of flour less highly milled or in some way re-inforced with wheat germ.

## WINDWARD ISLANDS.

### GRENADA.

*Area:* 133 sq. miles.

*Population:* 87,105 (1936).

*Birth Rate:* 31.98 per 1,000 (1936).

*Infant Mortality:* 104 per 1,000 births (1936).

*Death Rate:* 15.5 per 1,000 (1936).

1. *General*.—The papers consist of a despatch from the Governor covering a memorandum by the Senior Medical Officer. The formation of a local Committee is unnecessary as close touch will be kept with the Standing Committee on Nutrition in Trinidad.

2. *Composition and Nutritive Value of Dietary*.—The following locally grown foods form the bulk of the dietary of the working-class population. *Carbohydrates*: muscovado sugar, sweet potatoes, breadfruit, yams, cassava, maize; *proteins*: beans, peas, pork, poultry, fish, eggs and milk; *vegetables*: pumpkins, ochroes, cucumber, cress, spinach and onions; *fruit*: bananas, pawpaws, mangoes, apples, oranges and avocado pears; *nuts and oils*: coconut, breadnut, peanuts and cashew nuts. In addition, appreciable quantities of vegetable oils, wheat flour, rice, tinned milk, salted fish and meats, butter and butter substitutes are imported.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Signs of deficient nutrition are not marked in adolescents and adults, and although they suffer to some extent from lack of protein and vitamins the absence of rickets, scurvy, keratomalacia, etc., shows that such deficiency is not excessive. The standard of physical fitness among labourers in Grenada appears to be superior to that of East Indians in Trinidad. It is among children that the position is most serious. The Colony is almost entirely given over to the cultivation of economic and food crops with the result that the cattle population is insufficient to supply the necessary quantity of milk. In consequence, children and infants suffer severely; and this state of affairs is aggravated by the deeply rooted superstition that milk is the cause of worms in children. These harmful dietetic superstitions are wedded to profound ignorance on all matters pertaining to infant feeding and child welfare with the result that “marasmus” in infants is widespread. Despite this there has been a steady improvement in the infant mortality rates during the last few years.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—Owing to the fertile soil and abundant rainfall, food crops are easily grown. Many labourers have small gardens and are thus able to provide themselves and their dependents with sufficient quantities of food. Economic conditions, although not ideal, are at least as good as are to be found elsewhere in the tropical belt and with the recent commencement of public works likely to require a large amount of labour the future prospects of the Grenadian peasant are brighter than they have been for a considerable time.



5. *Researches and Surveys*.—A complete investigation by a nutritional expert is recommended as desirable; but the Governor considers that, at this stage, Grenada should be content to rely on the results of any investigations carried out in Trinidad, where the conditions are not dissimilar.

6. *Practical Measures for Improvement of Nutrition*.—There is general agreement that the first essential step is to train mothers and potential mothers in the elements of domestic economy and child welfare. The publication of a West Indian cookery book containing information on local foods and the best methods of preparing and cooking them would be invaluable for educational purposes, and the Trinidad authorities have been consulted in regard to the possibility of its compilation being undertaken there.

Every effort will be made to strengthen and expand maternity and infant welfare services as considerable results have already been obtained towards decreasing death rates due to the work of district nurses, midwives, and the children's ward of the Colony's hospital.

## WINDWARD ISLANDS.

### ST. LUCIA.

*Area*: 233 sq. miles.

*Population*: 65,026 (1936).

*Birth Rate*: 32.0 per 1,000 (1936).

*Infant Mortality*: 97.9 per 1,000 births (1936).

*Death Rate*: 14.9 per 1,000 (1936).

1. *General*.—A minute from the Senior Medical Officer and a despatch from the Administrator, make up the papers from St. Lucia, where no Committee has yet been set up.

2. *Composition and Nutritive Value of Dietary*.—Diets made up from the following foods are generally representative among servant classes in receipt of regular wages, town dwellers less well educated, and labourers in occasional employment: white bread, brown rice, cassava, flour, peas, beans, plantains, bread fruit, salt fish, cottonseed oil, cocoa and lime juice. Meat (pork) may be eaten once or twice weekly and fruit only occasionally. The diet is mainly carbohydrate and even if protein is included, it is usually not of the first class type. Beef, fresh milk and eggs are consumed only in very small quantities owing to their relatively high price. These dietary deficiencies are more exaggerated among East Indians, whose chief carbohydrate is brown rice or cassava, than among West Indians of African

origin who use cassava, yams, bread fruit and tannia interchangeably, although, it is true, there is a growing tendency among town-dwelling West Indians to substitute imported rice for local starchy foods.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The existence of these qualitative dietary defects is mainly reflected in the low resistance to disease and high incidence of infection. Septic infections are very prevalent and lowered resistance to disease is more marked among Indians than in Europeans. There is definite evidence that under-nourishment exists among children of both school and pre-school age; but beri-beri, pellagra, scurvy and rickets are unknown in the Colony. Boys selected for training at the Agricultural Experiment Station are at first small for their age, with a poor reserve of energy, and subject to malaria and digestive disease. During a two-years course of training, with regular habits and meals, a marked improvement in physique, intelligence and work output takes place.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Agricultural and fishing conditions in the Colony permit of a wide range of foodstuffs being produced to supply a much more protective diet than is at present customary; but it is difficult to interest the adult labourer in the matter since his earnings provide a bare margin for his needs, and he tends to accept malnutrition in his children as the natural state of existence. Recent legislation has brought about higher rates of wages than hitherto existed and the time seems appropriate to encourage a movement towards improved feeding conditions in order to put to the best use any small surpluses consequent on the improved earnings. Without education in regard to food, ameliorative economic efforts concerned with tariff adjustments and exemptions from duty will have little or no effect.

5. *Researches and Surveys.*—Existing knowledge is based on clinical observations; there are no facilities for specialised research work.

6. *Practical Measures for Improvement of Nutrition.*—It is the intention of Government to extend its maternity and child welfare services to the limit of available funds. The distribution of milk to school children is a measure which cannot be applied immediately, but will be borne in mind. The Agricultural and Education Departments will intensify their efforts to improve and increase the production of vegetable foodstuffs through the medium of "farmers' clubs" and school gardens. The keeping of goats for milk will also be encouraged; and the widest publicity will be given to the whole subject of nutrition by means of printed pamphlets and articles in local newspapers.



## WINDWARD ISLANDS.

## ST. VINCENT.

*Area:* 150 sq. miles.

*Population:* 56,511 (1936).

*Birth Rate:* 39·14 per 1,000 (1936).

*Infant Mortality:* 119·3 per 1,000 births (1936).

*Death Rate:* 16·35 per 1,000 (1936).

1. *General.*—A local Committee has been appointed which has since been reconstituted as a Standing Committee consisting of the Senior Medical Officer, Agricultural Superintendent, Inspector of Schools and Labour Commissioner, with the Chief Sanitary Inspector as Secretary. The Administrator forwards a copy of the report to this Committee, together with documents indicating the action taken to deal with the problem of malnutrition. The bulk of the despatch deals with the measures which have been, or are about to be, put into effect to cope with the situation, the unsatisfactory nature of which seems to be generally recognised.

2. *Composition and Nutritive Value of Dietary.*—No precise information exists on this but it is obvious that the diet is overwhelmingly a carbohydrate one, animal protein, vitamins and mineral salts being deficient or absent. Such foods as milk and eggs are not ordinarily consumed, and the same is true of fruit and green vegetables.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Sickness and disability due to underfeeding are widespread among children of school and pre-school age. The chief causes are poverty, overcrowding, insanitary housing conditions and destitution, consequent on the birth of children as a result of casual unions.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Little is reported under this head. As regards import tariffs there are no foods of high nutritive value ordinarily consumed by labourers or peasants which are heavily taxed.

5. *Researches and Surveys.*—There are no records of any research having been carried out. Any investigations, if practicable, should be co-ordinated for the whole of the West Indian Colonies taken together.

6. *Practical Measures for Improvement of Nutrition.*—It was decided in the first place to deal with the problem of undernourished school children and to endeavour to organise a daily

milk supply for them. Accordingly a note was made of all the schools in the Colony, of the amount of pasturage available at each school, of the number of cows required to provide a sufficient milk supply at each school and of the estimated number of undernourished children. Thereafter all the leading planters and heads of religious denominations were invited to give or lend cows to the schools and, where pasturage was not available on school or church lands, to provide this. There has been a fairly generous response to this invitation and a further report will be sent as the scheme progresses. Next, attention was directed to improving and expanding maternity and infant welfare services, and provision has been made for the appointment of individuals competent to organise and control infant welfare work throughout the Colony. Other measures which are being encouraged are the education of public opinion by means of propaganda lectures and the distribution of informative leaflets. A questionnaire has been circulated to schools with the object of obtaining information on the dietaries usually consumed and on the physical status and intelligence of pupils. This information is required before the problem of improvement in the nutrition of children can be systematically dealt with.



## ISLANDS OF THE WESTERN PACIFIC.

## FIJI.

*Area*: 7,083 sq. miles.*Population* (1936).

|          |     |        |
|----------|-----|--------|
| European | ... | 4,159  |
| Fijian   | ... | 98,291 |
| Indian   | ... | 85,892 |
| Others   | ... | 12,744 |

|       |     |         |
|-------|-----|---------|
| Total | ... | 201,086 |
|-------|-----|---------|

*Birth Rate*: 37.96 per 1,000 (1936).*Infant Mortality*: 109.76 per 1,000 births (1936).*Death Rate*: 20.17 per 1,000 (1936).

1. *General*.—A permanent Committee has been appointed to deal with the subject of nutrition in Fiji, and it is now engaged in obtaining information preparatory to a scientific examination by an officer who is undergoing a special course of training in America. At present, no precise information exists. Data from sources other than the report have been incorporated in this summary.

2. *Composition and Nutritive Value of Dietary*.—*Fijians*.—The standard food crops consist of ndalo, yams, cassava, kumala, kawai, bread fruit, coconuts and bananas. These are supplemented by green vegetables and leaves of wild plants. Fruits are abundant and sugar cane, which is widely cultivated, forms part of the staple diet. The majority of Fijians obtain an adequate supply of protein food from fish and shellfish obtained from the lagoons and rivers. In many instances the diet is supplemented by the purchase of bread, biscuits, butter, rice, tinned meat and tinned milk. The principal lack in the customary diet is that of fresh milk. Fresh cattle, meat and milk are rarely used; but pigs and poultry are kept in most villages and are consumed as occasion demands.

*Indians*.—The average diet consists of rice, dhal, green vegetables, poultry, eggs, fish (crayfish), milk, ghee, vegetable oils and sugar, with supplements of fruit and fish. Although ample in quantity there is some evidence that the Indian diet is deficient in calcium.

It is considered that, while the general value of the Fijian diet seems established by the manner in which the race continues to reproduce, it is probably poorly balanced, is marginal in vitamins A and B, and is short in protein.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—The average Fijian is physically very well developed. Superior development is also apparent among Fiji-born Indians as compared with immigrants from India. Under the heading of "food diseases", cases of epidemic

dropsy are recorded in recent reports from the Medical Department. Oedema of the lower extremities, anaemia, digestive upset and diarrhoea are characteristic of all cases. There is some evidence that the consumption of deteriorated rice may be a contributing factor. (For analogous findings, see under Sierra Leone, paragraph 3). Tropical ulcer is also seen in Fiji, but only appears among natives or East Indians at schools and other institutions, or in road gangs receiving food which approaches European standards. A return to native foods, fruits and fresh coconut milk drunk from the nut is the most successful treatment. Dental caries is of frequent occurrence among those Fijians who have ceased to adhere strictly to their customary diet.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—Fiji is fertile and sparsely populated, the population density being about 28 per sq. mile. Owing to the communal system of society there are no rich Fijians, but there is also no poverty. The Fijian is a landowner and under Native Regulations each adult male is required to plant and to keep in cultivation sufficient food crops to satisfy the requirements of himself and his dependants. All women are exempt from communal work in order that they may devote their energies to the care of their houses and children, and in many districts the husbands of pregnant women are temporarily exempt from work to enable them to provide adequately for the needs attendant upon childbirth.

5. *Researches and Surveys*.—The collection of exact information regarding existing diets and their nutritive value is considered necessary. Preliminary surveys to include physical examination of individuals in various age groups and a determination of the incidence of diseases attributable to malnutrition can be carried out by Medical Officers and in Government schools and other institutions. Biochemical and animal experiments can be undertaken in the new Pathological Laboratory. As the work proceeds provision of additional funds will probably be necessary. It is pointed out in the report that conditions in Fiji are very similar to those prevailing in Hawaii, and it is hoped that, when the results of nutritional problems at present being investigated in the University of Hawaii become available, Fiji may indirectly benefit. Fiji also offers scope for the study of changes in diet due to race-contact among the three main races, Fijians, Indians and Europeans.

6. *Practical Measures for Improvement of Nutrition*.—A growing amount of instruction is being given in the planting of crops for home consumption. At both Government and Mission schools food gardens are cultivated by the pupils under the direction of teachers. A considerable amount of work has been done through the Child Welfare Organisation in improving the



diets of mothers and young children, and adequate ration scales have been laid down for use in schools, hospitals and prisons. The investigations referred to in para. 5 must precede any attempt to formulate further measures for the application of scientific knowledge to the improvement of local conditions.

### GILBERT AND ELLICE ISLANDS.

|                             |     |        |                                    |  |
|-----------------------------|-----|--------|------------------------------------|--|
| <i>Area:</i> 180 sq. miles. |     |        | <i>Birth Rate:</i> 34·5 per 1,000  |  |
| <i>Population</i> (1936).   |     |        | (1936).                            |  |
| Native                      | ... | 32,761 | <i>Infant Mortality:</i> 245·9 per |  |
| Asiatic                     | ... | 893    | 1,000 births (1936).               |  |
| European                    | ... | 222    | <i>Death Rate:</i> 41·1 per 1,000  |  |
|                             |     |        | (1936).                            |  |
| Total                       | ... | 33,876 |                                    |  |

1. *General.*—The papers forwarded from the Gilbert and Ellice Islands comprise:—

(a) A non-professional interim report by the Resident Commissioner.

(b) Two reports by the Senior Medical Officer.

(c) A memorandum prepared by the Superintendent of Education.

(d) A review of food production in the Gilbert Islands by Sir A. F. Grimble, now Governor of the Seychelles, formerly Resident Commissioner in the Gilbert and Ellice Islands.

2. *Composition and Nutritive Value of Dietary.*—The normal native diet consists of coconut toddy which is drunk regularly by most adults, fish (fresh and dried), coconuts, pandanus and babai, a species of wild taro. To these, as delicacies eaten only rarely, may be added sugar-cane and bananas. Fresh milk is never obtainable; and fresh vegetables and meat are practically unknown. Eggs are scarcely ever eaten. The Carbohydrate content of the diet is thought to be unusually low; the protein is probably adequate as fish is highly favoured; indeed, the people have a craving for fish and will put out to sea in face of almost impossible weather conditions to get it. There is a known shortage of animal fat which is to some extent relieved, in men at least, by the eating of the revettus (castor oil fish) which is very rich in fat and is greatly valued in spite of the diarrhoea which it causes. Sir A. F. Grimble provides a useful account of the manufacture of coconut toddy and of the food uses of various products of the coconut and pandanus.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—The natives are by nature a healthy race, of good physical stamina and development. Beriberi, however, exists, and cases of apparent shortage of the anti-beriberi factor

without frank symptoms occur. There is also a very high incidence of a form of adenitis (usually cervical) among children and young adults which, clinically, resembles, but is not identical with, the tuberculous variety commonly seen in Europe. Although there are no supporting statistics, it is believed that the population has an unduly low resistance to influenza and the common cold. Chronically enlarged tonsils among native children are almost the rule. Infant mortality is high (averaging about 200 per 1,000 births) and is very probably connected with diet.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—The purchasing power of the native for imported foodstuffs is limited to about 10s. per head per annum. Any dietetic improvements to be expected from the adjustment of tariffs towards an increased use of imported foods must therefore be discounted. The native has no money to buy anything but the very cheapest and, therefore, the imported article most favoured is flour, the customary charge for which is 4d. per pound. At this price, and assuming the native devoted his entire purchasing power to buying flour, he could get only about 30 lb. of it in a year.

5. *Researches and Surveys*.—The Senior Medical Officer urges that a scientific and systematically controlled investigation of the whole nutrition question in these Islands be carried out.

6. *Practical Measures for Improvement of Nutrition*.—The application of certain desirable measures towards improvement, e.g. the free issue of tinned milk for infants and children, has proved impossible for reasons of cost. On the other hand, hundreds of pounds have been spent on the wide distribution of cod liver oil, but without any very striking benefit. The placing of whole meal flour within the purchasing power of the native is recommended. If it could be had for, say, 2d. and not 4d. per lb., the native could afford to buy about 60 lb. per head per annum which would do at least something to relieve the present (conjectural) shortage of carbohydrate in his diet.

## NEW HEBRIDES CONDOMINIUM.

*Area*: 5,700 sq. miles.

*Population* (1936).

*Approximate figures*.

|  |               |     |
|--|---------------|-----|
| (1) Europeans  | ...           | 950 |
| (2) Asiatics (other than those referred to in (3) below) | ...           | 130 |
| (3) Indo-Chinese coolies                                 | ...           | 850 |
| (4) Natives  | 40,000-60,000 |     |

*Birth Rate*:

*Infant Mortality*:

*Death Rate*:

No  
statistics  
available.



1. *General*.—These territories are administered jointly by British and French authorities and there are no Medical, Agricultural and Education Departments in the usually accepted sense. The Resident Commissioner forwards a report compiled with the help of the Medical Officer of the British Mission.

2. *Composition and Nutritive Value of Dietary*.—1. *Europeans, Asiatics and Indo-Chinese coolies*.—Generally speaking, Europeans have sufficient means to afford an adequate diet, both in quantity and quality, and their standard of health is good. Well-to-do Japanese and Chinese traders are likewise well provided for and are strong, healthy and rarely sick. They favour rice, fish, poultry, eggs and vegetables, but eat little meat and dislike milk. Indo-Chinese coolies receive rations under French regulations and are well cared for and frequently medically inspected. Their standard of health is mainly good and they stand up well to the rigours of plantation life, but suffer occasionally from beriberi. 2. *Natives*.—The natives may be roughly divided into three classes (a) bushmen, (b) salt-water or coast natives and (c) plantation labour. (a) *Bushmen*.—Bush natives are almost completely out of touch with civilisation. They live in the interior of islands and rarely come down to the sea or join a mission school. Their diet consists of yams, taro, manioc, coconut milk and oils, bread fruit, banana, sugar cane, nuts and vegetables. Their food is deficient in animal protein and they eat no salt. The birth rate is low, the infant mortality rate high and it is clear that in the bush only the fittest survive. Those who reach maturity are muscular, wiry and of great endurance. But the only time the bushman eats really well is when engaged on plantation labour where, on a more regular diet, he gains considerably in weight. (b) *Coastal natives* are those living near the coasts of the various islands. They are in continuous contact with missionaries, traders and Government Agents, and are the main source of plantation labour. They eat what the bushman eats but make more use of meat, fish and eggs and imported “white man’s luxuries” such as bread, biscuits, tea, sugar and tinned meats. In addition they consume quantities of local fruits. They use little or no salt. They are on the whole better fed and nourished than the bushmen and in consequence are able to do more and harder work. (c) *Plantation labourers*, who are recruited chiefly from bush and coastal natives receive rations and get more to eat than in their villages even under circumstances of comparative wealth. During life on plantations, the native generally improves in weight and physique. Plantation diets consist of rice, meat and fish, bread, tea, sugar and supplements of yam, taro, manioc and other native products. It is a curious fact that natives, particularly bushmen, eat little salt and dislike milk. Milk is regarded as a dirty food, and only the most sophisticated natives after long contact with whites can be prevailed upon to touch it.

### III

3. *Diet and Health (deficiency diseases and other relevant considerations).*—Deficiency diseases are practically unknown. A few mild cases of beriberi are occasionally seen on plantations, but these rapidly clear up when the labourer returns to his own village. Natives have, generally speaking, splendid teeth.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—When copra prices are high the salt-water and plantation native is well-off and has money to spend on food and clothes; but the question of how he is to maintain his prosperity standard when prices decline is a question which requires study. The bushman is virtually unaffected by the economic prosperity or depression in these islands. Biscuits, fresh fruit and vegetables, rice, cereals, potatoes, onions, beans and flour enter the New Hebrides duty free. Other foodstuffs pay a duty of 12 per cent. and it is unlikely that any reduction in this would affect local nutrition conditions.

5. *Researches and Surveys.*—No facilities exist for research or dietary survey work.

6. *Practical Measures for Improvement of Nutrition.*—The means at the disposal of the Condominium Government are exceedingly slender and there is little hope that it will be economically possible in the immediate future to put into effect any measures for improvement which may be considered desirable. The formation of a small Anglo-French Commission to study and advise the Joint Administration on the various aspects of the subject would no doubt be helpful.

#### SOLOMON ISLANDS.

|                                |     |        |  |  |
|--------------------------------|-----|--------|--|--|
| <i>Area:</i> 11,000 sq. miles. |     |        | <i>Birth Rate:</i> 22.0 per 1,000            |  |
| <i>Population (1931).</i>      |     |        | (approx.).                                   |  |
| Natives                        | ... | 93,415 | <i>Infant Mortality:</i> No data available.  |  |
| Europeans                      | ... | 478    |  |  |
| Asiatics                       | ... | 173    | <i>Death Rate:</i> 19.0 per 1,000 (approx.). |  |
| Total                          | ... | 94,066 |  |  |

1. *General.*—A detailed report prepared by the Senior Medical Officer has been submitted. The Group comprises nine large islands and numerous smaller ones inhabited by a heterogeneous people of varying races, cultures, religions and standards of living. Although the following summary treats with conditions as a whole, generalities are apt to be misleading, and a statement which is perfectly true of one island, or section of an island, may be entirely inapplicable to another part of the group. There are no Government schools and no Agricultural or Veterinary Departments in these islands, although advice is given by Fijian Departments.



2. *Composition and Nutritive Value of Dietary*.—The staple foods are taro, yams, panna, sweet potatoes, bananas, plantain, bread fruit, sago, cassava, native cabbage, ngali nuts, coconuts and fish. Supplementary to these but only occasionally eaten are maize, tropical fruits, flesh of wild pig, opossum and flying-fox, crabs, shellfish and the eggs of fowl, megapode and turtle. Cereals such as rice and maize have almost no place in the dietary. Fresh milk is unobtainable and the tinned variety expensive. From weaning until death the native consumes no milk and no milk products whatever. Speaking generally, the natives do not suffer from want of food, but the excessive carbohydrate and deficiency of fat, protein and vitamin A render the diet insufficient for the maintenance of perfect physical condition. The practice of betel nut chewing is general throughout the islands. It relieves hunger and is said to prevent tooth decay; but its effect on the gums is disastrous and every confirmed betel nut chewer has severe pyorrhoea. Imported foods such as rice, tinned meat and fish, and biscuits are only eaten very occasionally by natives who can afford them or when issued as rations to plantation labourers.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—Although there is no shortage of food, the fact that plantation labourers rapidly put on weight and improve in physical strength when on regular rations shows that the customary native diet is not fully adequate. There can be no doubt that the dietary deficiencies of the villagers are an important factor in lowering resistance to such infectious diseases as tuberculosis, leprosy, hookworm, malaria and influenza.

Night blindness and other pathological eye conditions due to vitamin A deficiency are frequent. Beriberi and scurvy are uncommon among the general native population but not infrequent among the plantation labourers when their diet is restricted to rice, biscuits and tinned meat. The incidence of tropical ulcer is high, especially where taro is the staple food; where fish is largely eaten, the incidence is much lower.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.)*.—As in the New Hebrides, here also the natives are either "bushmen" or "salt-water" coast dwellers. The establishment of law and order has altered the manner of life of the native and affected his nutrition to a profound degree. Formerly, the coastal peoples were the hereditary enemies of those in the interior, barring them from reaching the sea. The bushmen in their turn, were continually raiding the coastal natives and laying waste their crops and gardens. Now the two tribes are no longer concerned with war with the result that larger gardens are planted and the standard of agriculture is slowly improving. New varieties of foodstuffs are being introduced and food is

more abundant and more diversified in character than it used to be. The Protectorate depends for its revenue almost entirely on the export of copra and apart from those natives who sell their labour on plantations, each native community is dependent on its own subsistence agriculture. There appears to be little reason to hope or expect that improvement in nutrition will materially alter the economy of the Protectorate in the immediate future.

5. *Researches and Survey*.—Nothing has been done in this direction; but it is recommended that an attempt be made to collect accurate vital statistics, data on physical standards, and detailed information regarding the incidence of disease in relation to diet.

6. *Practical Measures for Improvement of Nutrition*.—Arrangements are under consideration for providing increased agricultural assistance. This is considered an essential preliminary to improving native living conditions. Encouragement should be given to natives to cultivate food gardens, and gifts of seeds to responsible villagers would be a desirable measure. Hitherto there have been no maternity and child welfare services; but the organisation of these is at present under consideration.

#### TONGA.

|                              |     |        |                                      |
|------------------------------|-----|--------|--------------------------------------|
| <i>Area</i> : 250 sq. miles. |     |        | <i>Birth Rate</i> : 35·70 per 1,000. |
| <i>Population</i> (1937).    |     |        | <i>Infant Mortality</i> : 100·59 per |
| Europeans                    | ... | 443    | 1,000 births.                        |
| Tongans                      | ... | 31,753 | <i>Death Rate</i> : 14·58 per 1,000. |
| Others                       | ... | 665    |                                      |
| Total                        |     |        |                                      |
|                              | ... | 32,861 |                                      |

1. *General*.—The papers include reports from the Agent and Consul and from the Acting Chief Medical Officer.

2. *Composition and Nutritive Value of Dietary*.—In general, the diet of a Tongan consists of root crops, such as yams, taro and kumaras, fish and a little meat. Pork and fowl are consumed on ceremonial occasions, which are frequent. The diet is deficient in milk, eggs, fruit and green vegetables. The Tongan likes fresh milk, but the trouble of feeding and milking cows dissuades him from keeping them. Eggs are plentiful but are not eaten; and the only green vegetables used are, generally speaking, the leaves of taro and cabbage. There is a very marked preference on the part of the native for tinned instead of fresh meat. Quantitatively the diet is sufficient but qualitatively it falls short of accepted standards, being deficient in vitamins A and D and in salts such as calcium, iron and iodine.



3. *Diet and Health (deficiency diseases and other relevant considerations).*—Judging by the physique and health of the average Tongan man and woman the diet might be regarded as satisfactory; but that pronounced qualitative deficiencies exist is evidenced by the amount of tuberculosis, cutaneous and eye diseases, septic conditions and low resistance to infection which is encountered. Pyorrhoea and dental caries are very common, and there is a certain amount of goitre which points to iodine deficiency. The prevalence of rheumatic infections may also have a bearing on the nutrition problem. Rickets and beri-beri are not met with; but degrees of anaemia are to be seen among children and adults.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—Except in the smaller coral islands, land is fertile, pastures are good and foodstuffs can be produced in abundance. The country is one of small-holders and there are no large towns to be fed from the land. There is little real necessity to import exotic foodstuffs and the question of tariffs is not therefore of major importance.

5. *Researches and Surveys.*—This question does not arise as no facilities exist.

6. *Practical Measures for Improvement of Nutrition.*—Practical measures already adopted by the Medical Department are the supply of cod liver oil to necessitous cases and of Glaxo for infant feeding. The teaching of food values and mothercraft has been adopted and included in the curricula of all schools. Provision has been made for the appointment of an additional trained European nurse to enlarge the scope of the work already being done with regard to infant welfare and ante-natal work. Further measures recommended are: the encouragement of children to eat wholemeal bread which should be imported from New Zealand free of duty; the suppression of the growing habit of sugar-eating and the eradication of the erroneous idea, commonly held in these islands, that the tubercular subject should abstain from animal fats. On the agricultural side, it would be advantageous to encourage the rearing of goats and to engender a taste for goat's milk. Milk and its products are rarely taken, and then only in the form of tinned milk. The growing of cabbages, carrot, spinach and tomatoes is another agricultural problem which needs development.

## ISLANDS OF THE SOUTH ATLANTIC.

## FALKLAND ISLANDS.

*Area:* 4,618 sq. miles.  
*Population:* 2,432 (1936).

*Birth Rate:* 18.8 per 1,000  
 (1936).

*Infant Mortality:* No data.

*Death Rate:* 8.79 per 1,000  
 (1936).

1. *General.*—A Board of nutrition has been established under the chairmanship of the Governor composed of 18 members representative of all interests in the Community. A number of Committees of the board have been formed for research and investigation, and for the agricultural and educational aspects of the problem. The population consists almost entirely of white people and has been derived to a large extent from the United Kingdom.

2. *Composition and Nutritive Value of Dietary.*—Mutton, tea and bread are staple articles of diet amongst the Falkland Islanders, supplies of fruit being irregular and costly except in urban areas. Milk consumption is low; good supplies of vegetables are, however, available. Although the normal dietary may be adequate in quantity it is ill-balanced and lacking in variety.

3. *Diet and Health (deficiency diseases and other relevant considerations).*—It is a striking fact that the major food deficiency diseases such as oedema, pellagra, beriberi, scurvy, rickets, xerophthalmia and night blindness do not occur. Nevertheless, the monotony and qualitative imbalance of the dietary is regarded as responsible for the considerable prevalence of dental caries, respiratory infections, appendicitis and constipation. Further, there is a well-founded impression that the Falkland Islander as a physical type tends to be below par, and Dr. Cheverton in 1936 showed that 42.7 per cent. of children in the Government School were below normal standard as judged by the Von Pirquet height and weight ratio. Information, however, which has been collected since that date in connection with the scheme for the distribution of milk in schools, referred to below, suggests that this figure may be an overstatement of the degree of the malnutrition existing.

4. *Economics of Diet (relation to local agriculture, cost, tariffs, etc.).*—A dietary survey is now in progress which will, it is hoped, provide data regarding the cost of living. The Medical Officer suggests that a duty might be levied on highly milled food products the proceeds of which could be used to encourage the consumption of whole wheat flour.



5. *Researches and Surveys*.—In the past, few precise observations relating to nutrition have been made. A dietary survey is being undertaken in Port Stanley to ascertain what the people do and do not eat and to work out any relationship which diet may have to the incidence of infection. Smaller investigations already begun include blood examinations with reference to the incidence of anaemia, and certain dental studies with a view to determining whether the prevalence of caries is related to malnutrition or is hereditary. Work is in progress on a comparison on the stature of the islanders during the last four generations. During the winter months it is hoped to undertake tests for deficiency of Vitamin C.

6. *Practical Measures for Improvement of Nutrition*.—A scheme has been instituted for the distribution, free of charge, of milk and a vitamin concentrate to students in schools who show signs of malnutrition. Under this scheme some 50 students have received a pint of evaporated full cream milk plus 1 c.c. of Radiostoleum (a vitamin A and D concentrate) each day. Records have been kept of the physical condition of the students concerned and in June, 1938, upon re-examination a number were so improved that they were removed from the list. The mean gain in height and weight of the general school population is being compared with the mean height and weight of the malnourished group over the same period with a view to the making of comparisons.

Other measures for improvement, either in force or envisaged for the future, are: health education by lectures and demonstrations, domestic science teaching in schools, the provision of pre-natal, infant and adult welfare clinics; and encouragement in the production of green vegetables, eggs and a reliable supply of fish.

#### TRISTAN DA CUNHA.

*Area*: 16 sq. miles.

*Population*: 183 (1937).

*Birth Rate*: 23·23 per 1,000  
(1937).

*Infant Mortality*: { No  
*Death Rate*: { data  
available.

1. *General*.—The most recent information is that collected by medical and dental officers attached to His Majesty's Ship "Carlisle" during a visit to the Island in 1937. Their reports show that conditions have somewhat altered since 1932, when an earlier report was made. Imported additions to the dietary have been followed by changes in the Islanders' outlook on life, and in their physical health: the condition of the teeth being somewhat adversely affected. Peaceable, contented, and

unemotional, the Islanders have developed these characteristics as the result of a simple minded acceptance of environment, rather than from apathy or sub-normal intelligence.

2. *Composition and Nutritive Value of Dietary*.—The water supply is abundant and easily accessible, and although open to pollution by cattle and poultry, no epidemics have resulted from this defect.

The ingenuity of the women has evolved many dishes the basis of which, in one form or another, is the potato, the staple food of the Islander. Fish, chiefly crayfish, are plentiful and are largely eaten; meat being reserved for festive occasions. Milk, butter and cheese are more easily procured than in civilized slum communities. The eggs of the albatross, mollyhawk and penguin are collected in Spring; and in Autumn, young sea-birds are caught, the carcasses giving an adequate supply of fat for cooking. Lettuce, cabbage, beans, onions and other vegetables are grown in the low-walled enclosure before each of the houses. Apples are the only fruit which ripen.

In contrast to the period pre-1932, 10 ships in three and a-half years have brought wheat flour, sugar, tea and other luxuries to the Island and now scones and bread are made several times a week. This novel factor probably accounts for the rising incidence of dental defects. Occasional rations of tinned fruit, tinned meat, biscuits and jam, gifts from visiting ships, are issued from a communal storehouse.

3. *Diet and Health (deficiency diseases and other relevant considerations)*.—For the maintenance of the exceedingly good health of the population the home-grown food is undoubtedly responsible. Infants are breast fed. Rickets, bow-legs, flat feet, arthritis, rheumatism, adiposity are absent. Up to the age of nine years, the children tend to be rather pot-bellied, and a mild form of bronchitis is all that the adults complained of. The medical report states that of 183 persons examined, 140 were in perfect health. The dental report, however, reveals that the gums of the people are by no means as healthy as they were in 1932. Against the five cases of gingivitis in 1932, there are now 48. Pyorrhoea is also slightly increased.

4. *Economics of Diet*.—The resources of the Island are adequate to support the community. A population of twice the number could be supported if Inaccessible Island were exploited for food production.

5. *Researches and Surveys*.—The British Medical Journal for 1932 and 1936 contains reports of surveys made by Sampson and Owen. The visit of His Majesty's Ship "Carlisle" in 1932 and 1937 may possibly be repeated.



In addition at the end of 1937 a party of six Norwegian scientists including a doctor and a dentist, under the direction of Dr. Erling Christophersen left England for Tristan da Cunha for the purpose of scientific research work. The investigations to be made amongst others included (*a*) a detailed survey of the health conditions of the population including clinical, physiological, and bacteriological-serological investigations and anthropometric measurements; (*b*) a detailed investigation of the state of caries and alveolar pyorrhoea and of the form and development of the teeth. An X-ray outfit was taken; (*c*) a survey of the social organisation and of the psychology of the population and an attempt to reconstruct a complete genealogy to be used in connection with the medical work.

6. *Practical Measures for Improvement of Nutrition.*—None required.

## SUB-SUMMARIES.

## MEDITERRANEAN.

*Cyprus*.—On the whole, dietary conditions are believed to be satisfactory except among the poorer classes who are subject to considerable disease consequent on underfeeding. There is great need for the extension of sound knowledge on elementary matters of food and nutrition. The Cypriot does not appear to consider fresh milk an important article of diet. Dietary surveys and active research on staple food products along well planned lines are advocated. This could be undertaken only with increased staff and facilities. The Medical Department and Government Analyst are already active in so far as time permits.

*Gibraltar*.—No serious nutrition problem can be said to exist in Gibraltar. Underfeeding due to poverty is recorded. Measures are in force to deal with it. The one question deserving of further study is whether the high incidence of pulmonary tuberculosis is related to nutritional deficiency; but no specific recommendations are made with a view to furthering such study.

*Malta*.—It appears that undernourishment is very common among the poorer classes, the worst sufferers being expectant and nursing mothers. Malta's infant mortality rate is abnormally high, being 286 per 1,000 in 1935. It is abundantly clear that one of the worst features of the situation is the very low consumption of milk. Goats' milk is the chief source of supply. The average daily consumption among those who drink milk is about 4 oz. per head, but a large percentage of the population drink no milk at all. Poverty and ignorance are the main causes of such malnutrition as exists. Numerous Government measures are in force with a view to improving conditions, special attention being directed towards the provision of an adequate milk supply for the general public and for Government charitable institutions and schools.

*Palestine*.—Among rural communities, the Jews consume a satisfactory diet, both qualitatively and quantitatively, while the Arab diet is often considerably below that generally considered necessary for normal requirements. Regarding urban populations, the attainment of dietary adequacy depends almost entirely on the prosperity of the groups concerned. Wide variations exist in the means and standard of livelihood of the different races and sections of the population and the nutrition position is liable to be profoundly and persistently modified by the rapid expansion of the population both by natural growth and immigration.



## AFRICA.

## EAST AFRICA.

*Note.*—Research for all the East African territories other than Somaliland is to be centred at Nairobi. Proposals are on foot to extend the work already being done.

*British Somaliland.*—The report submitted gives valuable information in regard to the very special conditions in the Territory. Important points are the fairly general quantitative lack of food, particularly among town dwellers; the almost entire neglect of green vegetables and fruit; the emphasis laid on the importance in the diet and the high nutritive value of camel's milk; the absence of parasitic infection so common in other East African countries; the characteristic physique of the race, the spare, lean bodily frame and yet an ability to endure long continued hardship and privation without apparent ill-effects.

*Kenya.*—With its well equipped laboratories and the stimulus given to nutrition study by the earlier activities of the Economic Advisory Council and Empire Marketing Board (1925-8), research has tended to move ahead of agricultural practice and policy. Although a certain amount of specialised nutrition research is still in progress, the weight of attention is now being directed towards agriculture and animal husbandry with a view to increasing the production and consumption of local foodstuffs and thus applying in practice the precepts regarding the need for improved nutrition emphasised as a result of the various dietary surveys and laboratory studies which have been completed.

To this end various schemes have been set on foot to educate the native in modern methods of pasture management, stock-breeding and improved cultivation. Eventually this policy must result in a general raising of the standard of native living.

*Tanganyika.*—In Tanganyika little nutritional research has been undertaken in the past although considerable data on the subject are now being collected. Consequently this report deals largely with measures necessary towards securing improved nutrition in the future, and to a less extent with past activities. There is abundant evidence that malnutrition exists but its precise extent has not yet been determined. It is generally agreed, however, that the majority of the population does not get enough meat and milk and that a major difficulty is the recurrent annual period of food shortage between harvests. A large percentage of illness suffered by the natives employed on estates is traceable to unbalanced dietaries. By improving dietary conditions, one employer has increased his average daily turn-out of labour from 50 to 98 per cent. The reviewing Committee detail the directions in which the Agricultural,

Veterinary, Education and Medical Departments are endeavouring to improve the situation. In addition to concentration on the improved production and distribution of meat and milk, and the encouragement of mixed farming and vegetable growing, the Committee advocate the abolition or reduction of existing duties on certain foods. Further, the appointment of a special nutritional research officer is strongly recommended.

*Uganda*.—Certain valuable and informative surveys have been carried out which show that faulty nutrition is responsible for a considerable amount of disease. Deficiencies of first class protein, fat and vitamin A are particularly noticeable. Further research is strongly advocated, especially the determination of basal metabolic rate in natives and the analyses of local food-stuffs. Important studies have been carried out in the Teso district in which both the Agricultural and Medical Departments co-operated. These might well serve as a model for similar investigations elsewhere in the Colonies. What appear to be adequate measures for the continued improvement of nutritional conditions are being actively prosecuted by the Medical, Agricultural and other Departments most closely concerned.

*Zanzibar*.—A detailed report of 20 printed pages has been submitted. Excessive carbohydrate and deficiencies in protein (both animal and vegetable) and animal fat are outstanding characteristics of the Zanzibar native diet. From medical observations, it is concluded that a marked degree of avitaminosis exists among the general population. Only one-third of the children can be described as well nourished. Towards improved nutrition, numerous practical measures, both agricultural and medical are described.

*Northern Rhodesia*.—A very detailed report has been submitted. Nutritional disease, which is considerable, is referable chiefly to dietary deficiency of protein, fat and vitamins normally provided by meat, milk and vegetables. Generally speaking, the consumption of these is insignificant, a circumstance which is reflected in the poor physique exhibited by large numbers of natives. Considerable attention is paid to the dietary requirements of the miners whose physique undoubtedly benefits during their employment. There is need for improvement in the rations given for agricultural, domestic and casual labour. A striking feature is the scant attention which has in the past been paid to native agriculture due to the slender resources of the Agricultural Department. The Committee recommend that the resources of the Agricultural Department be increased to enable it to encourage the development of subsistence agriculture along sound lines. The need for research is recognised, the Committee considering that the appropriate body to plan and supervise the necessary studies is the Standing Committee on Medical Research in East Africa. The part which for the present the Medical



Department will play in relation to the improvement of nutrition will be the extension, so far as possible, of maternity and child welfare work and the collection of information to guide the activities of the Administration and of the Departments of Education, Agriculture, and Veterinary Services.

*Nyasaland*.—The question of nutrition has been referred to the Native Welfare Committee which has submitted a detailed report. The staple foodstuff of the indigenous population is maize except in certain areas unsuitable for its cultivation, where cassava is relied upon. Both are eaten in the form of porridge. Local vegetable relishes play a very important part in the dietary. According to the standards accepted for non-tropical races the intake of first-class protein is inadequate, more especially during the important periods of childhood, pregnancy and lactation. The consumption of fats is also low and they are mainly of vegetable origin. Carbohydrate intake is adequate or even excessive. The intake of vitamins A and C during certain months must be reduced to a dangerously low level. It is probable also that local diets are deficient in calcium and phosphorus. There is a high incidence of catarrhal affections, conjunctivitis, and tropical ulcers which may be regarded as indicating a latent state of malnutrition in the population. Pellagra occurs, principally among the prison population. It is generally agreed that the native family could produce more food without additional labour by adopting better methods of agriculture. A comprehensive survey of diet in relation to health is at present being carried out with the co-operation of the International Institute of African Languages and Cultures, and under the scientific direction of Dr. B. S. Platt who has been appointed by the Medical Research Council to co-ordinate surveys on diet and health in colonial territories. The report also describes a series of practical measures which have been taken to improve the nutritional condition of the population and puts forward a number of suggestions for the future.

#### WEST AFRICA.

*Gambia*.—In general, the diet is excessive in carbohydrate (imported rice is the staple food) and deficient in animal fat and protein, mineral salts and vitamins. Infant mortality is very high and there is much disease of all kinds. Groundnut cultivation for export dominates the economic life of the Colony at the expense of other forms of agricultural industry. No scientific work has been undertaken, nor can be without expensive additions to present staffs. Research co-operation with other West African territories is considered desirable.

*Gold Coast*.—Broadly speaking, the diet is deficient in those animal and vegetable foodstuffs which provide fat, good protein, vitamins and mineral matter. In most parts meat is scarce,

expensive and of poor quality. The consumption of milk and eggs is negligible. Fish is plentiful on the coast where the standard of physique is higher than elsewhere. An increasing use of tinned foods is apparent. Tuberculosis and respiratory diseases are very prevalent and manifestations of classical food deficiency disease are frequent. There seems to be a connection between undernutrition and the incidence of leprosy. Nutrition research, although considered desirable, has not been undertaken owing to lack of facilities. It is recommended that a full-time dietetics research officer be appointed. The agricultural aspect of the problem is important. There are three systems of agriculture corresponding to the three climatic zones, namely the coastal savannah, the high forest, and the northern savannah. Agricultural and nutritional deficiencies spring for the most part in the case of the first two from the practice of shifting cultivation, in the case of the third from fixed or permanent farming inefficiently applied.

*Nigeria.*—Of first importance are the two broad distinctions between the North and South of Nigeria. The Northern staple is grain whereas that of the South is yams, cassava and root-crops. Secondly, in the North, cattle are used for the production of meat whereas in the South they are of negligible importance. Although one finds splendid physique among certain tribes (e.g., among fish eaters and beniseed eaters), physique is, in general, much below European standards owing to qualitative dietary deficiencies. The average diet is high in starchy foods and low in animal protein and fat, vitamins and minerals. Of deficiency diseases retrobulbar neuritis among the cassava eating people of the South is causing concern. This and other pellagroid conditions may be due to poisoning by toxic elements in cassava; but probably a B-factor deficiency is also involved. Considerable nutrition research has been done in Nigeria and much more is contemplated by the Medical Department; but a suggestion is made that the Colonial Development Fund might assist in a field experiment in the supplementary feeding of children. Noteworthy among the many practical measures suggested for the improvement of nutrition is the formation of Rural Health Units.

*Sierra Leone.*—As the staples are rice and palm oil and animal foods are eaten only sparingly, the diet is badly balanced and grossly deficient in animal protein and vitamins. Avitaminosis A and B is widespread, and infants and school children suffer considerably from rickets and other forms of malnutrition. Goitre is also prevalent in certain districts. Measures designed to improve conditions are engaging the active attention of the Agricultural and Medical Departments; but the Committee conclude that until further surveys of local conditions have been made, no adequate nutrition policy can be framed.



Accordingly, they recommend the appointment of two specialists, one competent to undertake nutrition surveys and the other a biological chemist.

*St. Helena.*—The population of St. Helena is of mixed ethnological origin and tends to be of poor physique. The diet consists of polished rice, small quantities of fish (when available), milkless tea, and very rarely includes vegetables. Little use is made of dairy produce, and many have never tasted milk since childhood. The flax industry cannot afford to increase the wages of its employees, and the low level of nutrition is consequent on poverty. Malnutrition begins early in life. Children are too tired after the walk to school to benefit from physical exercises. Two hundred cases of beriberi are reported. It is hoped to effect improvement by teaching Domestic Science, by increasing the production of dairy produce and vegetables and by supplying vegetables to the indigent.

#### SOUTH AFRICAN HIGH COMMISSION TERRITORIES.

*Basutoland.*—The question of food and nutrition is one of the most pressing problems that has to be faced in Basutoland and unless it is improved the position may become serious. Malnutrition is seen in every village, dispensary and school, and the progressive deterioration in native physique is becoming a subject of considerable comment. Energetic measures are being taken by Government to stimulate agricultural development.

*Bechuanaland.*—The physique and health of the Bechuana are considerably impaired by imperfect dietary conditions. There is considerable vitamin deficiency and widespread shortage of protein. Susceptibility to disease due to improper nourishment is high. Recently 33 per cent. of recruits for work on the gold mines were rejected as unfit. Poor water supply is at the root of the evil and much is being done to remedy this but it is also vitally important to educate the native in better dietetic habits. Hygiene is taught in the schools and many school gardens have recently been started. The activities of the Agricultural Department are expanding rapidly with beneficial results upon general health.

*Swaziland.*—The diet of the Swazi—maize porridge, supplemented by sour milk, pumpkins, sweet potatoes, beans, and meat occasionally—tends to be ill-balanced, being too high in carbohydrate, too low in protein and deficient in vitamins. Seasonal famine afflicts even the richer natives. Although, on a general impression, the adult appears to be healthy and well fed, clinical examination reveals undernourishment. Hospital patients benefit by the balanced institutional diet and invariably increase in weight. Signs of malnutrition were detected in over 80 per cent. of babies in a recent examination. The infant

mortality rate during the first year is nearly 40 per cent., half of the deaths taking place within the first two months. Scurvy makes yearly ravages on the child population and malaria is recurrent in the Southern district. Increased hospital facilities, child welfare work, improved agriculture, extended cultivation of groundnuts and other protein-rich foods and the development of storage facilities against times of scarcity will, it is hoped, effect improvement.

## EASTERN.

*Aden Colony.*—A comprehensive preliminary survey has been submitted which deals primarily with the Colony. The Protectorate will form the subject of a separate study. The Colony is almost entirely urban and is cosmopolitan in make-up. Arabs, Jews, Somalis and Indians of various races predominate. All the chief articles of diet are, with the exception of fish, imported from overseas or from Arabia. They are: rice, flour, sugar; fish, mutton, beef, goats' milk, eggs, ghee; fruits, vegetables, dates, lentils, sim-sim oil, tea, coffee and spices. In general the dietary would be fairly sound if adequate quantities could be guaranteed for all. Unfortunately, however, as the social scale descends the diet becomes quantitatively and qualitatively poorer, a fact which is reflected in the extent of deficiency disease in the poorer classes, particularly among children. On the whole the standard of public health is high, but there is much overcrowding, and respiratory and alimentary diseases are all too common. Diseases directly attributable to dietary deficiency are not a prominent feature of hospital returns in Aden, and the more classical of the tropical deficiency diseases—beriberi, scurvy and pellagra—do not occur. Evidence of qualitative deficiency is found, however, in the incidence of rickets among children and of certain eye infections. The peculiar local topography precludes the Colony from producing its own natural foodstuffs. The fishing industry and the local production of milk and eggs are exceptions to this general rule. Aden is a free port and therefore prices of essential foodstuffs are not raised by customs charges. Positive efforts for the improvement of nutrition are being made through the organisation of poor relief and the establishment of a fully equipped and adequately staffed Maternity Centre. The expansion of agriculture is dependent upon the provision of an adequate water supply. Proposals have also been made for the distribution of goats' milk for sale at controlled prices at various points in the Aden Settlement.

*Malaya.*—As a result of extensive work at the King Edward VII College of Medicine, Singapore, and at the Institute for Medical Research, Kuala Lumpur, there now exists very complete information regarding the composition and relative



values of Malayan foods, and considerable other data on nutritional conditions in Malaya. As rice is the most important food special consideration has been given to its nutritive value. A satisfactory variety is the husked unpolished rice prepared at the government rice mill in Perak. Root vegetables, leaves, pulses and palm oil are supplementary foods. Fish is the only animal food eaten to any extent, the consumption of meat, milk, butter and eggs being almost negligible. The most noteworthy deficiencies are of B-vitamins and protein. The markedly inferior physique, as judged by European standards, seen alike in Malaysians, immigrant Indians and Chinese is a striking feature, the most important point being that the divergence from European standards takes place only after the first six months of life. The incidence of dental caries is high especially among urban children, and it is presumed that the use of sophisticated foods and the extensive hawking of cakes and sweetmeats in town schools are the factors primarily responsible. Economic conditions have a direct bearing on nutritional status but, at any rate in one respect, in a manner opposite to that usually found in Western countries; improvement in general prosperity is coincident with an increased death rate from beriberi. The reason is that greater purchasing power enables the poorer classes to indulge the preference for the more expensive highly polished rice, and less attention is given to the growing of vegetables in garden plots. The local Nutrition Committee agree that, although much has been done, more investigation is necessary before any useful recommendations can be made with a view to putting into effect a co-ordinated nutrition policy.

*North Borneo.*—The staple food of the native of North Borneo is whole rice and tapioca. In consequence, beriberi is rarely seen among the indigenous population. It occurs, however amongst immigrant Chinese labourers working in timber camps, who consume polished rice. Other crops such as vegetables and fruit, maize, sweet potatoes, bamboo shoots and fern tops are more or less common to most districts. Animal protein and fat are deficient and the amount of carbohydrate is more than necessary for normal requirements. Goitre is endemic in the hilly regions and the question of providing iodised salt is at present under consideration. A predilection for edible earths is common, especially among women and children.

*Sarawak.*—Rice is the staple food both of immigrant Chinese and of the native population. Imports amount to anything up to 32,000 tons a year, and there is considerable local production. Other food crops include soya beans, millet, yams, maize, groundnuts and sugar cane. No nutritional research has been possible; consequently there is no information available on the relation between diet and disease.

*Hong Kong.*—Rice is the staple diet of the Chinese inhabitants. With the exception of a small amount of red rice consumed in the rural areas, white rice is almost exclusively used. This rice diet is augmented where means permit by small quantities of beans, vegetables, ginger, meat; fresh, dried or salted fish; and by fresh or salted eggs. The lowest paid wage-earners are able to buy very little of these additional foodstuffs and milk is almost unknown among the really poor. In judging of the general level of nutrition amongst the population it should be borne in mind that there has been a considerable influx of refugees into the colony since the outbreak of Sino-Japanese hostilities in 1937. Rickets, pellagra and scurvy are rare, but beri-beri is responsible for a heavy toll of suffering and death. The number of cases and deaths from enteritis in infants is also large and a proportion of these must undoubtedly be attributed to faulty feeding and malnutrition in some form. Oedema found in cholera cases also points to malnutrition, as does also the high incidence of pulmonary tuberculosis and of diseases of the respiratory system. The average daily earnings of members of the labouring classes are low and rentals are high for the standard of accommodation provided.

A Nutrition Research Committee has been set up and has already carried out useful work. Further work is needed, especially field work. Experiments are being planned on the production on a large scale of alfalfa and of spinach, both the true and the Chinese varieties. Other research includes inquiries into housing and labour conditions. Practical measures are being taken including the introduction of new dietaries in prisons and hospitals; the supply of free meals to nursing mothers and young children attending the two welfare centres; broadcast and newspaper propaganda; legislation for the purification of milk supplies; encouragement of milch herds and of the cultivation of vegetables; and experiments in the provision of a cheap anti-beriberi factor.

*Ceylon.*—Considerable information on Ceylon is available. The main articles of diet are rice and pulses, leafy vegetables and fish. About two-thirds of all foods consumed are imported. The bulk of the rice used is the imported polished variety, unpolished home grown rice being used only in certain country districts. The most serious deficiencies in the diets of the masses are those of animal protein, calcium, vitamin A and vitamin B complex. Nutritional disease is rife and the physical condition of poorer class children compares ill with that of their better fed contemporaries in the richer classes. The high infant mortality is in great part ascribed to maternal undernutrition, and every year large numbers of older children die from a multiple nutrition deficiency whose chief symptoms are stunted growth, wasting, skin eruptions and eye disease which invariably



results in blindness. A prominent and very harmful feature of Ceylon diets is the excessive consumption of condiments and highly spiced curry stuffs. Among the practical measures for improving nutrition special attention is directed to the need for teaching the principles of nutrition with particular reference to local conditions in the Medical College and in all schools. Emphasis is also laid on the urgent need for a greater production and consumption of milk; and a suggestion is made that it might be possible to utilise the vitamin B-rich yeast by-product from the manufacture of the local toddy. It is also proposed that a special Department of Nutrition be set up.

*Mauritius.*—The economic life of the Colony is dominated by its sugar industry, the staple foodstuffs (rice and pulses) being imported in exchange for exports of sugar. It appears that the earnings of the labouring classes are sufficient under present conditions to provide them with a reasonably adequate diet. The absence of gross deficiency disease and the healthy and well nourished state of the children attending elementary schools supports this view. Fundamentally the standard of nutrition is dependent on the degree of prosperity in the sugar industry and in the present circumstances the answer to the problem of dietary improvement is to be found chiefly in a rise in the level of wages. Any considerable improvement must, it seems, depend upon a rise in the price of sugar.

*Seychelles.*—The state of nutrition of the majority of the people is poor, low resistance to disease and incapacitating sickness being a constant source of economic loss to employers of labour. Rice is the staple food, the polished variety being used on the main island and unpolished in the outlying islands. The consumption of milk is very low and that of green vegetables almost negligible mainly because the natives have no natural liking for these articles of diet and partly also because praedial larceny is so habitual and widespread as to discourage potential producers. A major problem having a distinct bearing on nutrition is the abuse surrounding the manufacture and consumption of the native beverage known as La Purée. A dietary survey to include analysis of local foods is considered highly desirable.

## WEST INDIES AND NEIGHBOURING TERRITORIES.

*Bahamas.*—The diet of the great majority of the labouring classes who make up the bulk of the population is composed of milled cereals, fish, tinned or salted beef, bread without butter and tea without milk. The consumption of vegetables is low and is confined chiefly to the root varieties. Milk is too expensive for general use. Pellagra is very prevalent and malnutrition accounts for a great deal of illness and debility. The

incidence of dental caries is also exceedingly high. Important among the several measures being taken to improve nutrition is the encouragement of backyard vegetable farming and the intention to review existing tariffs with a view to stimulating an increased consumption of foodstuffs of high nutritive value.

*Barbados*.—The local Nutrition Committee stress the great shortage of milk and eggs and fresh vegetables in the diets of the working classes. The poor physique of the average labourer, the high incidence of tuberculosis and dental caries, and the prevalence of pellagra provide sufficient evidence that diets are seriously deficient. Low wages and large families are the chief causes of this state of affairs. A scheme to provide free milk to school children, and the encouragement of "backyard" vegetable growing are among the more important measures which have been adopted by Government towards improving conditions.

*Bermuda*.—Practically every family eats some meat or fish once a day, though much of it is from tins. Salt cod is extensively used and fresh vegetables are eaten in fair quantities. In view of the general healthiness of the people and the absence of gross deficiency disease, malnutrition does not appear to be a pressing problem. Dental caries is, however, prevalent. Where diets are defective this is due as a rule to the raising of too large a family upon the income available. A beginning has been made towards the practice of birth control under the direction of the Health Department.

*British Guiana*.—With the possible exception of milk, there exists no quantitative shortage of foodstuffs essential to the health of the Colony. The source of nutritional disease—which is especially prevalent among immigrant East Indians—must therefore be looked for in terms of poverty, racial prejudice, restricted availability of certain foods in hinterland or isolated areas, general dietetic ignorance or a combination of two or more of these. The chief difficulty about milk is its most unsatisfactory quality due to adulteration and contamination. Further research is recommended and particulars are submitted of a three years' programme to include dietary and health surveys, and experimental work on food analysis and the feeding of school children. It is considered that the work envisaged will not necessitate the appointment of highly paid experts but may well be undertaken by existing staff if provision is made for the employment of subordinate personnel and for additional equipment.

*British Honduras*.—There is a wide difference in the dietetic habits of the racial groups. No manifest deficiency disease occurs to any marked extent, although a certain amount of



malnutrition undoubtedly exists. If the people could be persuaded to eat quantities of the easily accessible fruit, doubtless all signs of scurvy and other incipient C avitaminosis would disappear.

The Committee recommend a dietary survey of all sections of the community and detail measures which may be immediately initiated to encourage local production of green food-stuffs, to secure increased nutritional hygiene and education by welfare centres.

*Jamaica*.—Although there is no lack of variety nor shortage of food, the diet of the poorer classes is undoubtedly deficient in animal protein and fat, and contains much salted fish, polished rice and white flour. The nutritional state of a distressingly large proportion of the labouring classes and of children is considered by some observers to be definitely bad, the chief causes being adverse economic conditions, poverty, low wages, unemployment, illegitimacy and over-large families. Conditions are aggravated by the prevalence of yaws, hookworm infection and malaria. Measures for the improvement of present conditions include the development of animal husbandry as a source of meat supply. Improvement of fisheries and development of poultry farming will receive attention. A scheme has been put into operation for the establishment of lunch kitchens in a number of elementary schools; and the provision of a daily supply of milk to the schoolchildren of Kingston is engaging the attention of the Government.

*Antigua* (Leeward Islands).—Nutrition is said to be fairly good on the whole among people of working age; children and old people are the chief sufferers. For many children corn-meal "pap" with sugar is almost the sole article of diet and in a recent survey it was found that the great majority of school children get no milk, eggs or meat. The problem is largely an economic one, poverty among working class parents being the chief factor. The Governor suggests as advisable a general nutrition survey of the whole Leeward Islands group. A five-year scheme has already been submitted for improving agriculture in which special provision is made for the development of livestock. The milk situation requires investigation and a greater use of goats' milk is advocated.

*Dominica* (Leeward Islands).—This report emphasises the improvement in general health which has taken place in recent years, as evidenced by falling death and infant mortality rates, and as a result of an active campaign against yaws and syphilis. Milk, butter and meat are insufficiently available and, in any case, are too expensive for the poorer labouring classes who subsist mainly on imported cereals and salted fish, local root crops, bananas, pigeon peas (*Cajanus indicus*), coconuts and unrefined sugar. Malnutrition is most serious among infants

and pre-school children and is largely due to notoriously bad infant feeding practices. Older children and adults do not apparently suffer from so much malnutrition. This is surprising in view of the nature of the diet available to the poorer classes and the bad start which very young children obviously get.

*Montserrat* (Leeward Islands).—The problem of nutrition is not a pressing one in this island where the climate is good and where the population largely consists of peasants cultivating their own small holdings. The diet is varied and plentiful and milk and meat are cheap. Nevertheless, there has recently been a tendency to undue concentration on the production of export crops at the expense of production of food for home consumption. Normally the people are robust, energetic and apparently well fed, and it is only among expectant mothers and very young children that malnutrition is seen to any extent.

*St. Kitts-Nevis* (Leeward Islands).—No detailed study of nutrition has been made in this Presidency. Apparently the problem is not an urgent one, although it is clear that poverty among working class parents results in frequent undernourishment in children. The high cost of beef, mutton and milk restricts their use by the poor.

*Virgin Islands* (Leeward Islands).—It is stated that the staple food is an abundance of West Indian vegetables and fresh fish, and an unlimited supply of fresh, non-tubercular cow's milk. Nutritional diseases are practically non-existent and the physique of the people in general and children in particular is excellent. Their limbs are straight and sturdy, and their skins healthy and with scarcely a blemish.

*Trinidad*.—It is well known that the diet of the East Indian labourer who forms a large proportion of the population is grossly deficient in animal protein, fat, and vitamins and that, in consequence, his general physique and capacity for work are definitely inferior to that of the West Indian. Xerophthalmia and a peculiar chest condition ascribed to vitamin B deficiency are general among East Indians and constitute a serious problem the only solution to which lies in educating the East Indian regarding the necessity of adopting a suitable diet. The diet of the West Indian also leaves much to be desired. Accordingly the local Committee are concentrating their efforts on the best practical means to bring about an increased production and consumption of such foods as milk and green vegetables rather than embarking on the scientific and research aspects of the problem. The provision of adequate milk supplies (including goats' milk), the encouragement of vegetable gardening, and the importation of less highly milled flour for bread making are three important measures to which the Committee are giving their attention.



*Grenada* (Windward Islands).—The general picture seems to be that food crops are easily grown and therefore, despite a certain degree of poverty and a high population per square mile, there is little undernutrition except among infants and young children for whom the milk supply is wholly inadequate. On all matters pertaining to infant feeding, harmful dietetic superstitions are wedded to profound ignorance with the result that “marasmus” in infants is widespread. There is general agreement that the first essential step towards improvement is to train mothers and girls in the elements of domestic economy and child welfare. The publication of a West Indian Cookery Book would be invaluable for educational purposes, and the Trinidad authorities have been approached in regard to its compilation. In the matter of research, too, a close liaison will be maintained with Trinidad, no investigations being in the meantime contemplated in Grenada.

*St. Lucia* (Windward Islands).—Dietary defects revolve round the insufficient consumption of fresh milk, meat, eggs, green vegetables and fruit. Septic infections are very prevalent and lowered resistance to disease is general, especially among East Indian labourers. Classical deficiency diseases such as beriberi, pellagra, scurvy and rickets are, however, unknown. Malnutrition is apparently very general among children and adolescents. Proof of this is to be found in the fact that youths undergoing training at the Agricultural Cadet School, where regular habits and adequate diets are the rule, improve markedly in physique, intelligence and output of work.

*St. Vincent* (Windward Islands).—The fact that malnutrition exists, especially among children, is taken for granted. The report contains a straightforward account of the prompt measures which have been taken to cope with a situation regarding the unsatisfactory nature of which nobody seems in doubt. The Administration have successfully organised a novel scheme for supplying milk to school children and have put in train measures to improve and expand maternity and child welfare services and to educate public opinion by means of lectures, leaflets and other forms of publicity.

## ISLANDS OF WESTERN PACIFIC.

*Fiji*.—Both the native Fijians and the East Indians who compose the majority of the population are physically well developed and there is an almost complete absence of the well-known deficiency diseases. Nevertheless, there is some evidence that the customary diet is marginal in protein and vitamins of the A and B groups; and the most outstanding dietary deficiency is certainly that of fresh milk. There have been several occurrences of epidemic dropsy (ascribed in some cases to eating

deteriorated rice), and tropical ulcer is also seen especially when native fruits and fresh coconut milk are discarded in favour of imported European foods. All adult males are required by law to grow sufficient food crops to satisfy their home requirements, and the husbands of pregnant women are temporarily exempt from communal work to enable them to devote attention to family needs. Dietary and health surveys and biochemical research on foods are considered necessary before further attempts can be made to improve local conditions.

*Gilbert and Ellice Islands.*—The normal diet of the natives consists of coconut toddy, fish, coconuts, pandanus and babai. Fresh milk is never obtainable, and fresh vegetables and meat are practically unknown. The general poverty and the high cost of imported foods prohibit their purchase in any quantity. There is a shortage of fat in the diet and a probable shortage of carbohydrate. Beriberi is common and there is a high incidence of cervical adenitis among children and adolescents. Infant mortality is high, averaging about 200 per 1,000 births. A scientific study of the whole question is desired. It is recommended that measures be taken to place wholemeal flour within the purchasing power of the native in order to make good the shortage of carbohydrate in the diet.

*New Hebrides Condominium.*—These Islands are administered jointly by British and French authorities and there are no Medical, Agricultural and Education Departments in the usually accepted sense. Neither do facilities exist for research, nor are funds likely to be available for effecting improvements in nutrition, however desirable. The population is mainly composed of bushmen out of contact with civilisation, "salt-water" or coast natives, and plantation labourers. Foods are plentiful and available in considerable variety; and conditions, on the whole, are fairly good. With the exception of a few mild and very occasional cases of beriberi, deficiency diseases are practically unknown. Milk is never drunk as a prejudice exists against it.

*Solomon Islands.*—The Report submitted treats individually with conditions prevailing in the nine largest islands which make up this group. Food is plentiful and diversified in character; but there are deficiencies of fat, protein and vitamin A which give rise to a considerable amount of night blindness and other pathological eye conditions. Tropical ulcer is also prevalent, especially among natives who eat little or no fish. A striking feature is the entire absence of milk from the dietary. From weaning until death the native consumes no milk and no milk products whatever. The practice of betel nut chewing is general throughout these islands. It relieves hunger; but its effect on the gums is disastrous. It is considered that increased provision



for agricultural advice is an essential preliminary to improving conditions. Agricultural and Veterinary Departments do not at present exist.

*Tonga*.—In general, the diet of a Tongan consists of root crops such as yams, taro and kumaras, fish and a little meat—the tinned variety being preferred. Milk, eggs, fruit and green vegetables, although available, are not usually eaten. As regards diseases attributable to the local diet, medical opinion mentions, in particular, tuberculosis, cutaneous and eye diseases, septic conditions, goitre and anaemia. Practical measures for improvement recommended as desirable are the importation of wholemeal flour duty free; the keeping of goats for milk purposes; and the extended cultivation of green vegetables.

### ISLANDS OF THE SOUTH ATLANTIC.

*Falkland Islands*.—Mutton, tea and bread are staple articles of diet among the Falkland Islanders, and local medical opinion emphasises that in dietary imbalance and monotony lies the answer to the problem of the prevailing high incidence of dental caries, appendicitis, constipation and respiratory infections. General physique is somewhat poor. A scheme has been instituted for the free distribution of milk and cod liver oil to students in schools who show signs of malnutrition. Some 50 students have received a pint of evaporated full cream milk plus 1 c.c. of Radiostoleum each day. Records of the physical condition of the students concerned are being kept. A considerable improvement has been noted in some cases. Researches on anaemia, dental caries and blood calcium content are being undertaken out of local resources, and a dietary survey of Port Stanley is proposed.

*Tristan da Cunha*.—The staple diet of the Islanders consists of milk, fish, eggs and vegetables. The excellent health prevailing on the Island is shown by the fact that, of 183 persons examined in 1937, 140 were declared to be in perfect health.

A rising incidence of dental caries, gingivitis and pyorrhoea may be correlated with the increasing frequency of visits made by ships bringing wheat flour, jam, sugar, tea and tinned foods as well-intentioned gifts to the Island.

## APPENDIX.

## POPULATION, BIRTH RATE, INFANT MORTALITY AND DEATH RATE.

Data marked \* refer to certain districts or towns and not to the whole territory.

NOTE.—The figures given should in most cases be regarded as no more than a rough approximation.

|   | Population<br>(total). | Birth Rate<br>(per 1,000) | Infant<br>Mortality<br>(per 1,000<br>live births). | Death Rate<br>(per 1,000) |
|---|------------------------|---------------------------|--|---------------------------|
| <b>1. MEDITERRANEAN.</b>                                  |                        |                           |  |                           |
| Cyprus ... ..   | 367,000                | 34                        | 105  | 12                        |
| Gibraltar ... ..  | 19,000                 | 19                        | 62   | 15                        |
| Malta ... ..  | 262,000                | 34                        | 190  | 18                        |
| Palestine ... ..  | 1,317,000              | 42                        | 153  | 19                        |
| <b>2. AFRICA.</b>   |                        |                           |  |                           |
| <i>East.</i>  |                        |                           |  |                           |
| British Somaliland ...                                    | 345,000                | —                         | —  | —                         |
| Kenya ... ..  | 3,262,000              | —                         | —  | —                         |
| Tanganyika ... ..   | 5,063,000              | —                         | —  | —                         |
| Uganda ... ..   | 3,661,000              | 26                        | 159  | 20                        |
| Zanzibar ... ..   | 235,000                | 16                        | —  | 17                        |
| Northern Rhodesia ...                                     | 1,378,000              | —                         | —  | —                         |
| Nyasaland ... ..  | 1,623,000              | —                         | —  | —                         |
| <i>West.</i>  |                        |                           |  |                           |
| Gambia ... ..   | 199,000                | 25*                       | 370*   | 31*                       |
| Gold Coast ... ..   | 3,617,000              | 35*                       | 108*   | 25*                       |
| Nigeria ... ..  | 20,224,000             | 29*                       | 140*   | 17*                       |
| Sierra Leone ... ..                                       | 1,672,000              | 23*                       | 210*   | 21*                       |
| St. Helena ... ..   | 4,340                  | 32                        | 120  | 15                        |
| <i>South African High<br/>Commission Territories.</i>     |                        |                           |  |                           |
| Basutoland ... ..   | 664,000                | —                         | —  | —                         |
| Bechuanaland ... ..                                       | 260,000                | —                         | —  | —                         |
| Swaziland ... ..  | 156,000                | —                         | —  | —                         |
| <b>3. EASTERN.</b>  |                        |                           |  |                           |
| Aden Colony ... ..  | 46,000                 | 32                        | 197  | 32                        |
| Malaya ... ..   | 4,660,000              | 44*                       | 171*   | 25*                       |
| North Borneo ... ..                                       | 270,000                | 27*                       | 163*   | 25*                       |
| Sarawak ... ..  | 443,000                | 33*                       | 233*   | 25*                       |
| Hong Kong ... ..  | 1,029,000              | 32                        | 361  | 34                        |
| Ceylon ... ..   | 5,631,000              | 34                        | 166  | 22                        |
| Mauritius ... ..  | 411,000                | 35                        | 142  | 26                        |
| Seychelles ... ..   | 30,000                 | 27                        | 92   | 14                        |
| <b>4. WEST INDIES AND NEIGH-<br/>BOURING TERRITORIES.</b> |                        |                           |  |                           |
| Bahamas ... ..  | 66,000                 | 33                        | 66*  | 19                        |
| Barbados ... ..   | 188,000                | 32                        | 198  | 19                        |
| Bermuda ... ..  | 31,000                 | 23                        | 71   | 11 <sup>a</sup>           |
| British Guiana ... ..                                     | 328,000                | 35                        | 120  | 20                        |
| British Honduras ... ..                                   | 56,000                 | 34                        | 153  | 20                        |
| Jamaica ... ..  | 1,139,000              | 32                        | 118  | 17                        |



|   | Population<br>(total). | Birth Rate<br>(per 1,000) | Infant<br>Mortality<br>(per 1,000<br>live births). | Death Rate<br>(per 1,000). |
|---|------------------------|---------------------------|--|----------------------------|
| WEST INDIES AND NEIGH-<br>BOURING TERRITORIES—<br><i>continued.</i> |                        |                           |  |                            |
| Leeward Islands—  |                        |                           |  |                            |
| Antigua ... ..  | 34,000                 | 37                        | 111  | 20                         |
| Dominica ... ..   | 48,000                 | 32                        | 100  | 14                         |
| Montserrat ... ..   | 14,000                 | 39                        | 119  | 15                         |
| St. Kitts-Nevis ... ..  | 38,000                 | 36                        | 163  | 26                         |
| Virgin Islands ... ..   | 6,165                  | 38                        | 141  | 18                         |
| Trinidad ... ..   | 448,000                | 33                        | 97   | 16                         |
| Windward Islands—   |                        |                           |  |                            |
| Grenada ... ..  | 87,000                 | 32                        | 104  | 16                         |
| St. Lucia ... ..  | 65,000                 | 32                        | 98   | 15                         |
| St. Vincent ... ..  | 57,000                 | 39                        | 119  | 16                         |
| 5. ISLANDS OF THE WESTERN<br>PACIFIC.                               |                        |                           |  |                            |
| Fiji ... ..   | 201,000                | 38                        | 110  | 20                         |
| Gilbert and Ellice<br>Islands                                       | 34,000                 | 34                        | 246  | 41                         |
| New Hebrides<br>Condominium   | 50,000                 | —                         | —  | —                          |
| Solomon Islands ... ..  | 94,000                 | 22                        | —  | 19                         |
| Tonga ... ..  | 33,000                 | 36                        | 101  | 15                         |
| 6. ISLANDS OF THE SOUTH<br>ATLANTIC.                                |                        |                           |  |                            |
| Falkland Islands ... ..   | 2,000                  | 19                        | —  | 9                          |
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